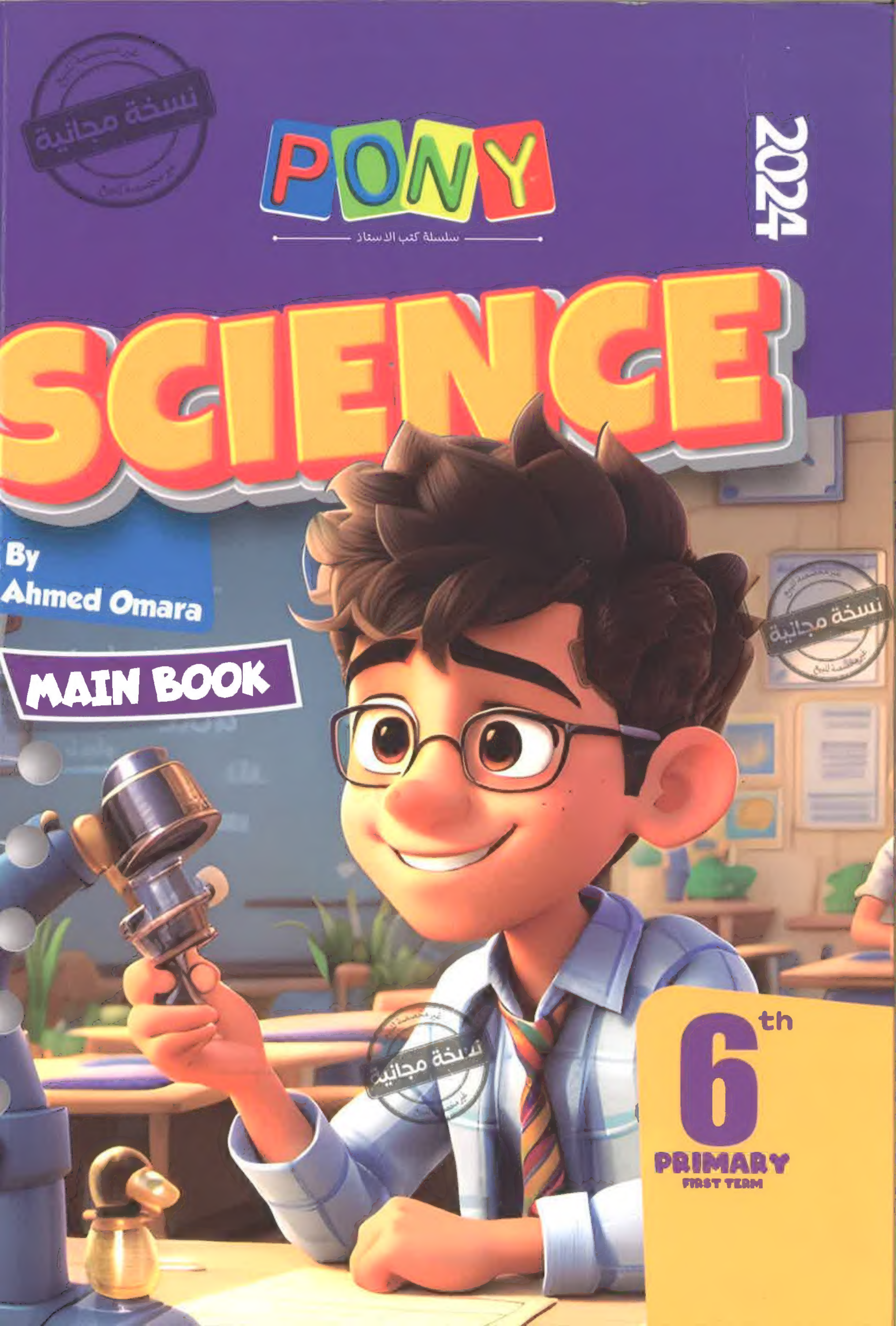


نسخة مجانية
PONY
سلسلة كتب الاستاذ
2024
SCIENCE
By
Ahmed Omara
MAIN BOOK
نسخة مجانية
نسخة مجانية
6th
PRIMARY
FIRST TERM

Contents

Theme 1: Systems

Unit 1 What Is a System?

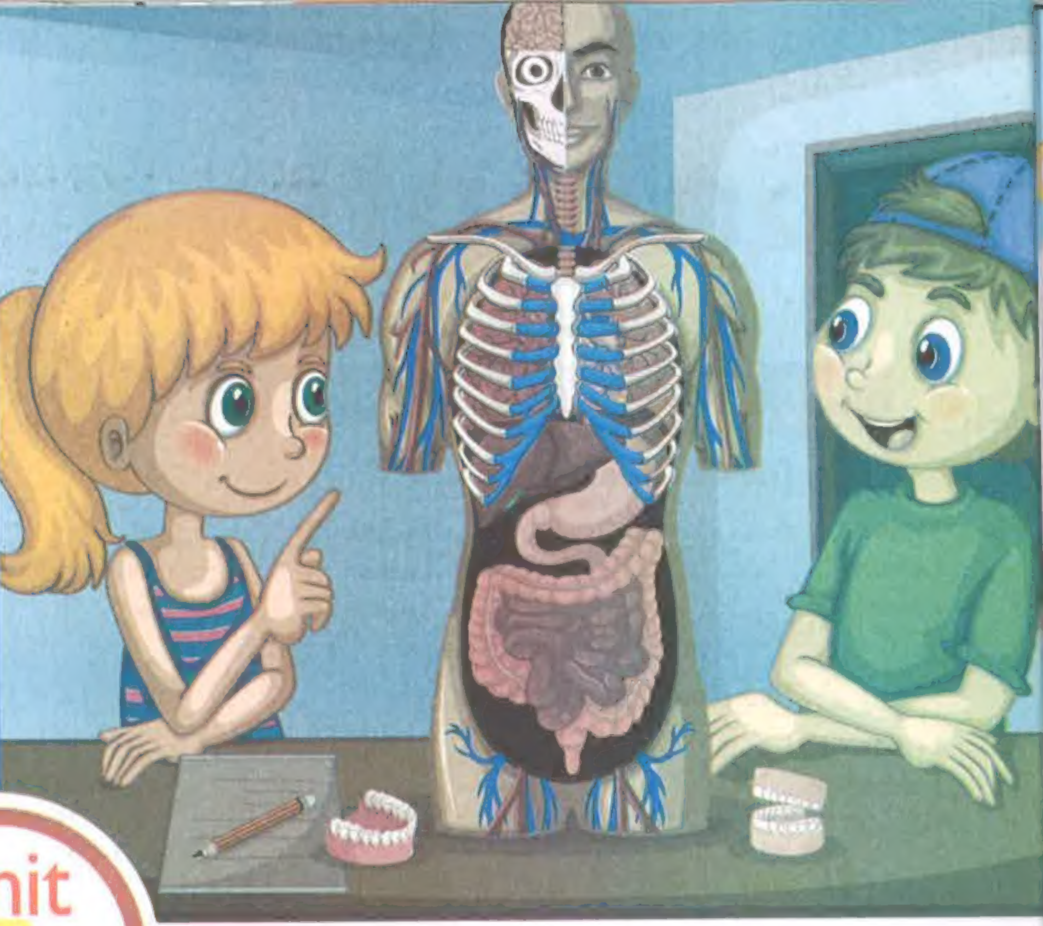


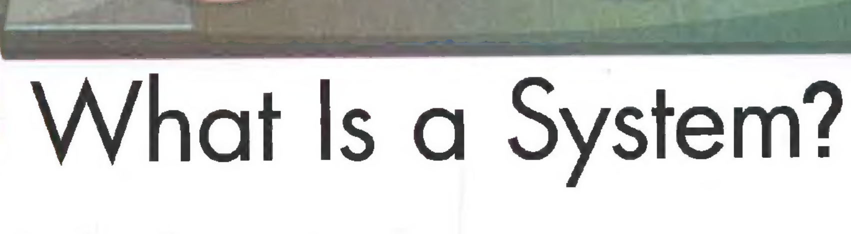
Theme 2: Matter and Energy

Unit 2 Getting Energy









What Is a System?

Unit Concepts:

- Concept 1 The Cell as a System
- Concept 2 The Body as a System
- Concept 3 Energy as a System
- Unit Project: Support System

Unit Objectives

In this unit, we will study:

1. How systems are made up of many parts, working together to complete a common task.
2. How the human body is one large system made of many small systems, the smallest of which is the cell.
3. How interruptions to one part can affect how a whole system functions.
4. How energy can be transferred within a system to power a device to do a job.
5. How different physical parts, such as magnets or power sources, can be used to create a working electrical system, called a circuit.

Get Started

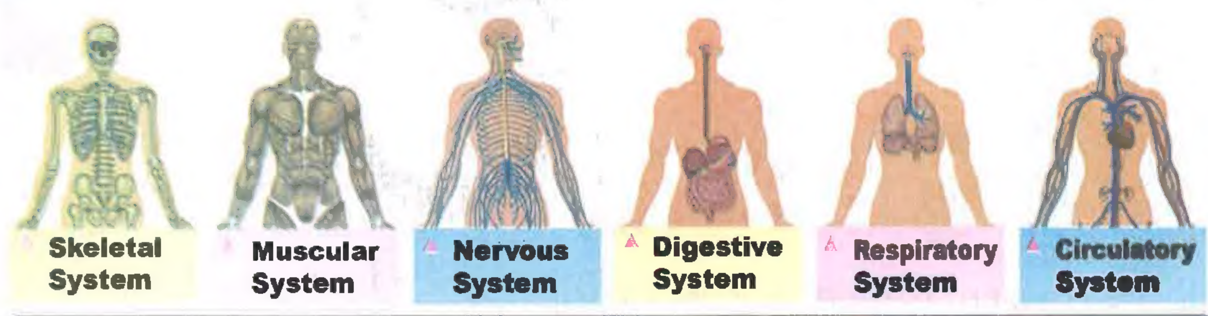
What I Already Know



What do you know about systems



- In science, we refer to systems of the human body based on their structure and function, for example:
- A system involves different parts working together in a specific way.





ما الذي تعرفه عن الأنظمة؟

- في العلوم، نشير إلى أنظمة جسم الإنسان بناءً على بنيتها ووظيفتها، على سبيل المثال، الجهاز الهيكلي والجهاز العضلي والجهاز العصبي والجهاز الهضمي والجهاز التنفسي والجهاز الدوري.
- النظام يحتوي على أجزاء مختلفة تعمل معًا بطريقة معينة.



How do scientists gather information about the different parts of a system



Figure 1



Figure 2

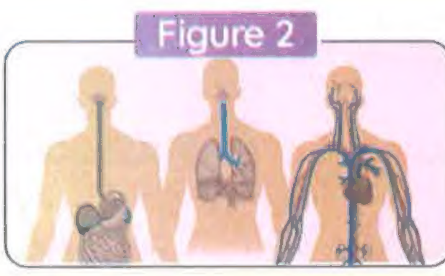


Figure 3



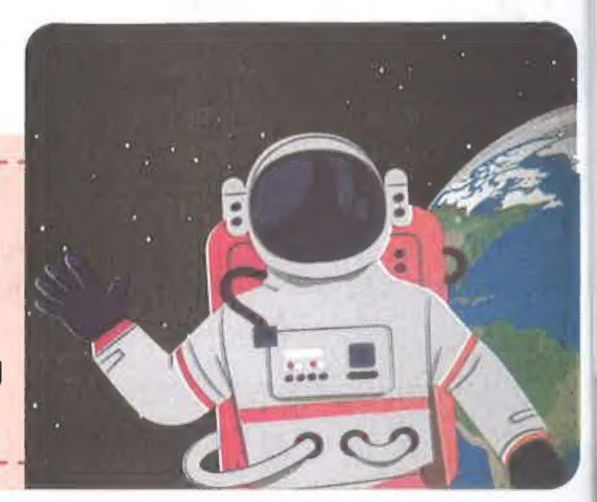
- In figure 1, the scientist is using a microscope.
- In figure 2, a scientific illustrator has created an image of different body systems.
- In figure 3, the door lock system shown uses a magnet.

كيف يقوم العلماء بجمع المعلومات عن الأجزاء المختلفة من النظام؟

- في الصورة الأولى، هناك عالم يستخدم الميكروسكوب.
- في الصورة الثانية، رسم توضيحي علمي يُصوِّر أنظمة مختلفة في جسم الإنسان.
- في الصورة الثالثة، يتم قفل الباب الموضح مغناطيسيًا عن طريق استخدام المغناطيس.

Unit 1

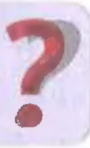
Astronaut Physical



» Astronauts who journey into space must cope with changing environmental conditions, which can be hard on the human body system.



How can astronauts get ready before they leave Earth?



1. They must make sure that their bodies are functioning properly.
2. They must train to be in peak physical condition before they leave Earth.
3. They must also undergo rigorous physical examinations to qualify for travel.

« اللياقة البدنية لرواد الفضاء:

- يجب أن يتعامل رواد الفضاء مع الظروف البيئية المتغيرة التي من الممكن أن تكون قاسية على نظام جسم الإنسان.

« كيف يستعد رواد الفضاء قبل مغادرتهم للأرض؟

1. يجب عليهم التأكد من أن أجسامهم بصحة جيدة.
2. يجب أن يتدرب رواد الفضاء حتى يكونوا في أفضل حالة بدنية قبل مغادرتهم الأرض.
3. يتعين عليهم أيضًا إجراء فحوصات جسدية صارمة للتأهل للسفر.

Unit Project — Support System

» In this activity, students should design an innovative product to support astronauts as their bodies deal with the challenges presented by living in an environment of very small gravity.

« يدعم مشروع الوحدة الطلاب لتصميم منتج مبتكر لدعم رواد الفضاء حيث تتعامل أجسامهم مع التحديات التي يمثلها العيش في بيئة الجاذبية الصغيرة جدًا.



Concept 1
The Cell as a System

Concept Objectives:

By the end of this concept, students will be able to:

- Investigate and collect evidence that supports the idea that living things are made of cells.
- Develop a model to describe the function of a cell as a whole and how the parts contribute to the overall function.
- Argue from evidence that living things are made up of either one cell or many different numbers and types of cells.
- Compare animal cells and plant cells.

Key Vocabulary:

- Bacteria
- Cell wall
- Cell
- Chloroplast
- Cell membrane
- Cytoplasm
- Endoplasmic reticulum
- Organ
- Golgi apparatus
- Mitochondria
- Plasma membrane
- Multicellular
- Unicellular
- Nucleus
- Vacuole

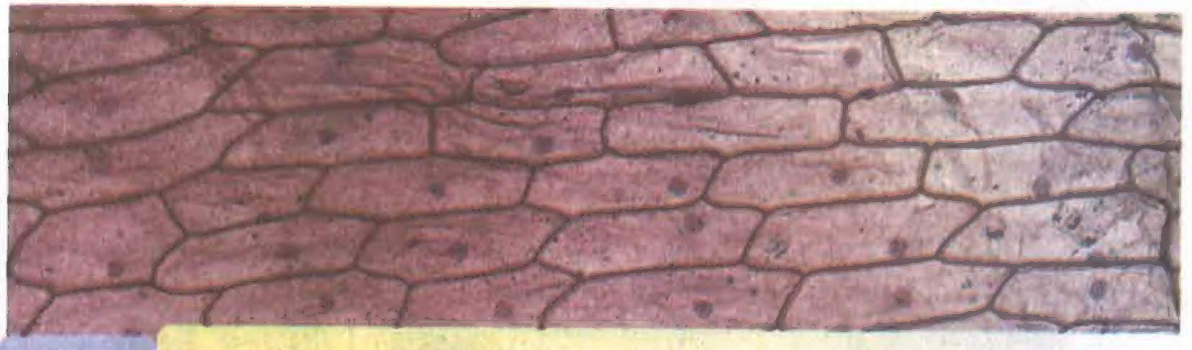
Concept 1

The Cell as a System





- In this unit, you will focus on systems in our world.
- The first system we will consider is the cell.



Cells • They are the basic units, or building blocks, of life on Earth.

- Cells are found only in living organisms.
- Cells are very small. We need a microscope to see them.

Cells function:

- Cells carry out all the functions that organisms need to live, such as:

1. Growing
2. Repairing themselves
3. Reproducing
4. Responding to the environment



• في هذه الوحدة، سنركز على الأنظمة في عالمنا.
• النظام الأول الذي سننظر فيه هو «الخلية».
• الخلايا: هي وحدات بناء الكائنات الحية.
• توجد الخلايا في أجسام الكائنات الحية فقط.
• الخلايا صغيرة للغاية، حيث نحتاج إلى ميكروسكوب لرؤيتها.
• وظيفة الخلايا:
– تؤدي جميع الوظائف التي تحتاج إليها الكائنات الحية لتعيش وتشمل تلك الوظائف:
1 النمو. 2 تعويض الخلايا التالفة. 3 التكاثر. 4 الاستجابة للبيئة المحيطة.





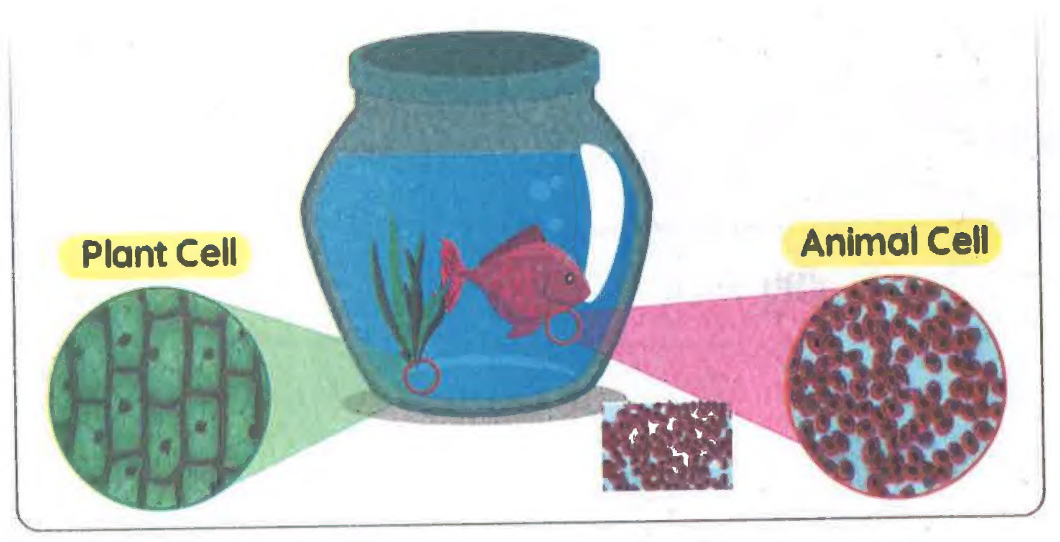
Unit 1

Activity 2 Building Blocks of Living Organisms



What is the common thing between plants and animals





- Both plants and animals are living organisms made of cells.
- The cells of plants and animals are different in shape and size.

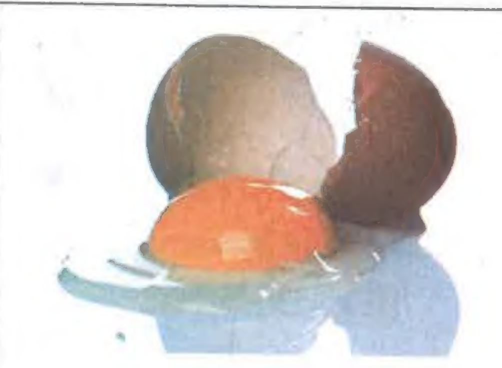
Cells as Building Blocks

- Just as the toy building blocks can be used to create castles, cells are the building blocks that form many different living things.
- A cell is the smallest basic unit of life, and it's responsible for all of life's processes.
- Cells are the structural, functional, and biological units of all living beings.



- ما هو الشيء المشترك بين النباتات والحيوانات؟
  - كلاهما كائن حي يتكون من عدد من الخلايا.
  - تختلف خلايا النبات عن الحيوان في الشكل والحجم.
- الخلية كوحدة البناء:
  - كما نستخدم المكعبات اللعبة لإنشاء القلاع، فإن الخلايا عبارة عن وحدات تشكل العديد من الكائنات الحية المختلفة.
  - الخلية هي أصغر وحدة أساسية للحياة، وهي مسئولة عن جميع العمليات الحيوية.
  - الخلايا هي وحدات التركيب، والوظيفة، والحياة لجميع الكائنات الحية.

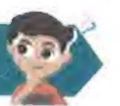
Size of the Cell

Most cells are very small	Some cells are very large.
Examples	
• **Common plant or animal cells** They are between 0.005 and 0.1 mm long. • **Bacteria** They are usually smaller than this.	• **An unfertilized bird egg**  It contains only one egg cell. • بيضة الطائر غير المخصبة تحتوي بداخلها على خلية واحدة فقط.
 You will need a **microscope** to see them.	

NOTE:

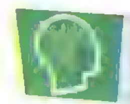
- The unaided human eye can see objects that are about 0.1 millimeters (mm) long.
- العين البشرية المجردة يمكنها رؤية الأشياء التي يبلغ طولها ما يقرب من 0.1 ملليمتر.

Check your understanding?



Put (✓) or (✗):

- Cells are usually very small. ( )
- The unaided human eye can see the cells of bacteria. ( )





Activity 3 What Do You Already Know About the Cell as a System?

Organism Growth and Cells



- Living organisms grow and reproduce by increasing the number of cells.
- All new cells come from existing cells.

تنمو الكائنات الحية وتتكاثر، من خلال زيادة عدد خلاياها.

Properties (Characteristics) of Cells:

- Most cells are so small and cannot be seen without a microscope.
- Living organisms are classified according to the number of cells into:

1. Unicellular organisms: 

   They are organisms made up of **only one** cell.

   Ex. Bacteria 

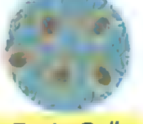
2. Multicellular organisms:

   They are organisms that have **more than one** cell.

   Ex. Complex organisms, such as humans, animals and plants.

- Our bodies contain many different kinds of cells with different functions.


Blood Cells


Brain Cells


Muscle Cells

- الخلايا صغيرة للغاية، حيث نحتاج إلى ميكروسكوب لرؤيتها.
- يمكن تقسيم الكائنات الحية من خلال عدد الخلايا إلى نوعين:

كائنات أحادية الخلية: هي الكائنات التي تحتوي على خلية واحدة مثل البكتريا.

كائنات متعددة الخلايا: هي الكائنات التي تحتوي على أكثر من خلية واحدة مثل: الإنسان أو الحيوان أو النبات.

• تحتوي أجسامنا على العديد من الخلايا المختلفة التي تقوم بوظائف مختلفة.



NOTES:

- All cells consist of a cell membrane.
- Not all cells have a nucleus, such as red blood cells.

Activity  4 Cell Needs

- Cells are microscopic building blocks of all living organisms.
- The cell is a complex structure that carries out all its own life activities.





Skin cells under the microscope

Give a reason for... 

- Cells are important.

Because cells carry out all the functions that organisms need to live, such as:

1. Growing
2. Repairing themselves
3. Reproducing
4. Responding to the environment

Basic Needs of a Cell

- The basic needs of a cell are similar to the needs of all organisms, such as:

  1. Oxygen gas and food to get energy
  2. Water

- Cells have a way of taking in the needed materials and using them to get energy, grow, and live.
- Cells have a way of releasing waste products.

• الاحتياجات الأساسية للخلية:

تتشابه الاحتياجات الأساسية للخلية في جميع الكائنات الحية وهي:

1 غاز الأكسجين والغذاء للحصول على الطاقة.

2 الماء.

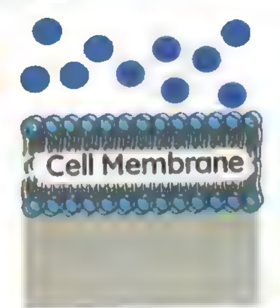
• الخلايا لها وسيلة لأخذ العناصر اللازمة واستخدامها للحصول على الطاقة والنمو والبقاء.

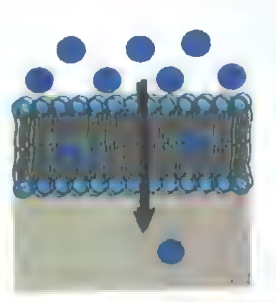
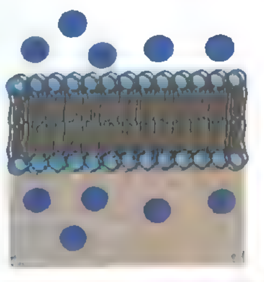
• الخلايا لها وسيلة للتخلص من الفضلات.

Cell (Plasma) Membrane

It controls (regulates) which substances can enter or leave the cell.

Outside the cell



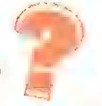



Inside the cell



Give reasons for...

1. The cell membrane allows water to enter the cell.
   Because water is a basic need for the cell to live.
2. The cell membrane allows water to leave the cell.
   To maintain the proper water balance on both sides of the cell membrane.



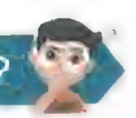
What happens if...



- Too much water enters the cell.
  The cell will swell until it bursts.

• الغشاء الخلوي:
– يتحكم الغشاء الخلوي في المواد التي تدخل أو تخرج من الخلية.
– يسمح الغشاء الخلوي للماء بالمرور داخل الخلية حيث إن الماء ضروري للحياة.
– يسمح للماء بالخروج من الخلية؛ وهكذا تكون الخلايا قادرة على الحفاظ على توازن الماء على جانبي الغشاء الخلوي.
– إذا دخل الكثير من الماء إلى الخلية، فستنتفخ الخلية حتى تنفجر.

Check your understanding?



Put (✓) or (✗):

1. Although cells are very small, they are what keep us alive. (   )
2. Cells must have a way of taking in waste products. (   )
3. Some substances can pass through the cell membrane, while others cannot. (   )

Exercises on Lesson 1

1 Choose the correct answer:

1. The .... is the building unit of a living organism's body.
   a. brick b. cell c. organ d. blood
2. Humans are .... organisms.
   a. unicellular b. prokaryote
   c. multicellular d. simple
3. An unaided human eye can see an object .... millimeters long.
   a. 0.01 b. 0.005 c. 0.5 d. 0.001
4. An unaided human eye can't see all the following, except ....
   a. an onion's cell b. a skin's cell
   c. a bacterial cell d. a bird's unfertilized egg cell
5. A living organism grows and reproduces by increasing the .... of its body cells.
   a. number b. size c. volume d. length
6. All the following are multicellular living organisms, except ....
   a. a bean plant b. a cat c. bacteria d. a human
7. All the following are from the basic needs for the cell, except ....
   a. water b. oxygen c. food d. carbon dioxide
8. The .... regulates the substances that pass in or out of the cell.
   a. nucleus b. plasma membrane
   c. cell wall d. cytoplasm
9. Which statement about the cells is false?
   a. All living organisms are composed of cells.
   b. All cells come from existing cells.
   c. Most cells are microscopic in size.
   d. All cells have a nucleus.

Unit 1

2 Put (✓) or (✗):

1. Most cells are usually very small. ( )
2. The unaided human eye can see a bacteria cell. ( )
3. Different living organisms have similar cells that have similar functions. ( )
4. Increasing the number of the living organism's cells occurs during reproduction process only. ( )
5. The cell membrane allows water to enter the cell, but not to leave it. ( )
6. There must be a water imbalance at the two sides of the cell membrane, so that the cell won't burst. ( )
7. The cell membrane allows only the needed substances to enter the cell. ( )
8. Scientists can use a telescope to see the very small cells. ( )
9. An unfertilized bird egg contains more than one egg cell. ( )
10. Multicellular organisms consist of only one single cell, such as the plant cell. ( )

3 Write the scientific term:

1. They are the building units of life on Earth.
2. They are living organisms, and their bodies consist of more than one cell.
3. They are living organisms, and their bodies consist of only one cell.
4. It's a device used to see very small cells as a plant cell.
5. It controls the substances that enter or leave the cell.
6. It's a gas which the cell needs to get energy and perform its vital activities.
7. They're materials released from the cell.
8. It's a liquid material that is necessary for the cell to do its function well.

4 Complete the following sentences using the words between the brackets:

(nucleus – shape – oxygen – energy – cell membrane – size – waste products – food)

1. Cells in our body are different in .... and .... because they have different functions.
2. All cells are composed of a ....
3. A cell takes in .... and .... to get ...., but it releases ....
4. Not all cells contain ....

5 Correct the underlined words:

1. Most cells are very **large**, so we can see them with our naked eyes.
2. A cell is a **simple** structure that carries out its vital activities.
3. Bacteria are **multicellular** living organisms.
4. Living organisms can be divided into multicellular and unicellular organisms according to the **size** of cells in their bodies.
5. The cell will **shrink** when too much water keeps entering it.

6 Cross out the odd word:

1. Plant – Bacteria – Animal – Human
2. A skin cell – A plant cell – An animal's cell – A bird's unfertilized egg cell
3. Oxygen – Water – Carbon dioxide – Food

7 Choose from column (A) what suits it in column (B).

Column (A)	Column (B)
1 A cell membrane	a. is smaller than 0.005 mm long.
2 A bird's unfertilized egg cell	b. length ranges between 0.005 to 0.1 mm.
3 Bacterium	c. controls the amount of water that enters the cell.
4 A skin cell	d. is a very large cell.

1 .... 2 .... 3 .... 4 ....

8 Study the following figures, then complete the sentences below:

1. Figure .... represents a bacterial cell, as it consists of .... cell(s).
2. Figure .... represents the cells of a human skin.

Figure a | Figure b

9 Give reasons for:

1. The cell provides the structure of the living organism's body.

   ....

2. A plant is considered a multicellular organism.

   ....

3. Bacteria are considered unicellular organisms.

   ....

4. You can see a bird's unfertilized egg, but you can't see your skin cell without a microscope.

   ....

5. The cell membrane is very important for the cell.

   ....

6. The cells of the same living organisms are different in shape and size.

   ....

7. The amount of water must be balanced at the two sides of the cell membrane.

   ....

10 What happens if:

1. The cell can't get its basic needs?

   ....

2. The cell membrane is absent in an animal cell?

   ....

3. Too much water enters the cell?

   ....





Activity  Brief History of the Cell

The scientist: Robert Hooke:



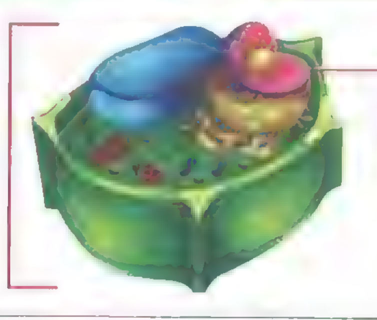
- In 1665, he used the newly invented microscope to observe some too small things to be seen by the unaided eye.
- He looked at samples and described little sections in them.
- He was the first person to use the word "cell".

العالم روبرت هوك:
- في عام ١٦٦٥م، استخدم الميكروسكوب الذي تم اختراعه حديثًا لمراقبة الأشياء الصغيرة جدًا التي لا يمكن رؤيتها بالعين المجردة.
- فحص هوك بعض العينات ووصف الأجزاء الصغيرة فيها.
- كان هوك أول شخص يستخدم كلمة خلية لوصف هذه الصور الدقيقة.



Improved microscopes have allowed scientists to make new discoveries, for example:

The nucleus of a cell was discovered through observation of numerous plant cells.	Later, scientists determined that cells are the basic unit of structure in living things.



سمحت أجهزة الميكروسكوب المطورة للعلماء باكتشافات جديدة، على سبيل المثال:
- تم اكتشاف نواة الخلية من خلال مراقبة العديد من الخلايا النباتية.
- وفي وقت لاحق، توصل العلماء إلى أن الخلية الوحدة الأساسية للبناء في الكائنات الحية.

Give reasons for...



1. Scientists have developed microscopes.
   To be able to look at small things in more details.

2. Scientists used information learned from one another's research.
   To understand cells better today.

- قام العلماء بتطوير أجهزة الميكروسكوب؛ لرؤية تفاصيل الأشياء متناهية الصغر.
- ساعد ذلك على أن يصبح في إمكان العلماء اليوم استخدام المعلومات المستنتجة من أبحاثهم لفهم الخلايا بشكل أفضل.

What happens if...



- The microscope wasn't invented.
  Scientists would not be able to discover the cell and its structure.







Activity 6 Hands-on Investigation: Using a Microscope to View Cells

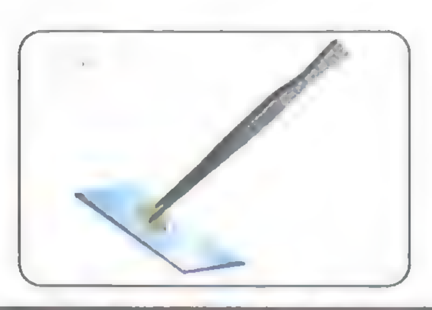
Experiment

» In this activity, you will also make observations and draw what you see when you look at the skin of an onion under a microscope.

Tools:



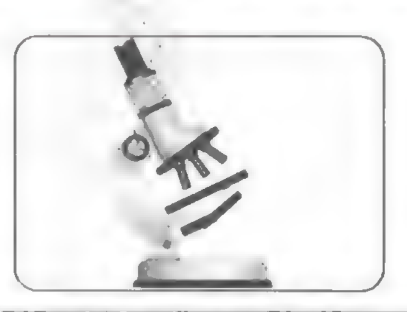
Slice of skin of an onion



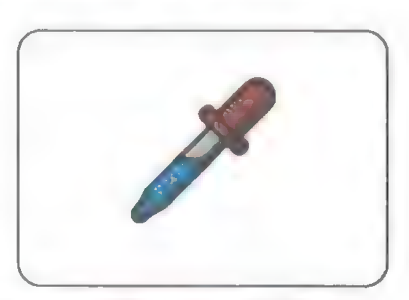
Slide of skin of an animal



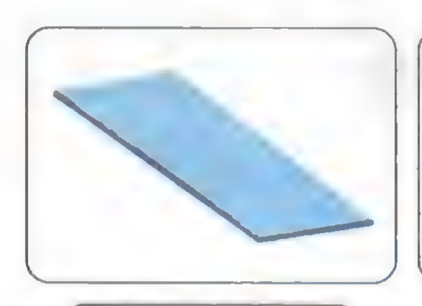
Distilled water



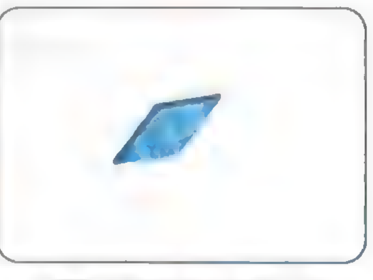
Compound microscope



Eyedropper



Glass slide

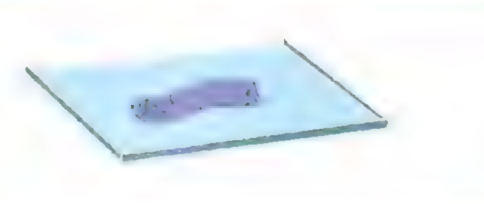


Coverslip

Unit 1

Steps:

1. Place the thin membrane of an onion in the center of a glass slide.

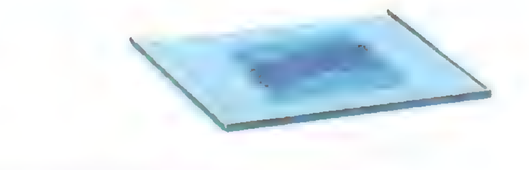


2. Add 3 drops of distilled water to it.



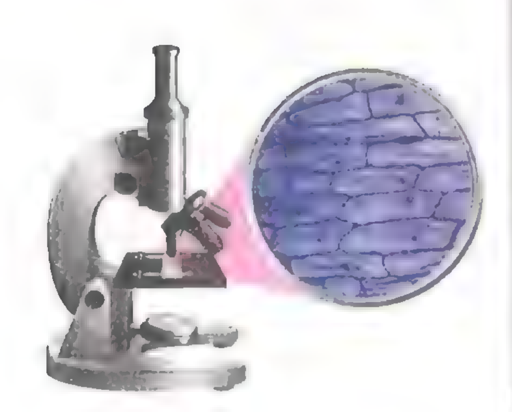
3. Carefully place the coverslip over it.

4. Examine the sample under the compound microscope.



5. Repeat the previous steps on a slide of skin of an animal.

Observations:



- The samples of an onion and an animal consist of small units known as cells.
- The shape of the cells is different for the two samples.
- Each cell contains many components.

Conclusion:

- Cells are the smallest building units that form different living organisms.

Compound Microscope

Importance:

» It magnifies cells that can't be seen by the unaided eye.

Structure:

Eyepiece
We look at the specimen through it.

Tube
Collecting the light from the sample for clearer image.

Coarse Focus
Fine Focus
Adjusting the clear focus on the specimen.

Objective Lenses
Changing the magnifying power by changing the objective lens.

Arm
Holding and moving the microscope.

Stage
The slide is placed on it.

Stage Clip
Securing the slide on the stage.

Illuminator
Providing a light source to see the specimen.

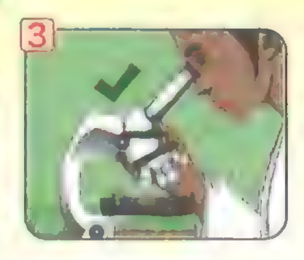
Base
Holding the microscope up.

Microscope parts functions are for illustration.

Steps of using the microscope:









1. Place the microscope slide on the stage and secure it with the stage clips.
2. Pick up the lowest-power objective lens.
3. Look at the slide through the eyepiece while adjusting the focusing knobs to get more clear view of the specimen.
4. Clean up the slide and store the microscope safely when you are finished.

Exercises on Lesson 2

1 Choose the correct answer:

1. .... was the first scientist to use the word "cell".
   a. Newton b. Hooke c. Edison d. Einstein
2. The nucleus was discovered during an observation of an enormous .... cell.
   a. animal b. bacterial c. human d. plant
3. Scientists concluded that the .... is the basic unit of the organism's structure.
   a. cell b. organ c. tissue d. system
4. All the following are form the parts of a compound microscope, except the ....
   a. eyepiece b. objective lenses c. illuminator d. objective mirrors
5. The membrane of an onion consists of similar units called ....
   a. cells b. nuclei c. organs d. tissues
6. You can change the power of magnifying of a microscope by using another ....
   a. objective lens b. eyepiece c. mirror d. arm

2 Put (✓) or (✗):

1. Developed microscopes have allowed scientists to make new discoveries. (   )
2. Sometimes a single cell exists on its own as in bacteria. (   )
3. The membrane of an onion consists of different units called cells. (   )
4. The cell in an onion membrane contains many components. (   )
5. A leaf cell and a red blood cell can exist in the same organism. (   )
6. Scientists must be open to new ideas about how cells work. (   )

Write the scientific term:

1. It's a device that can be used to magnify cells.
2. They're the identical building units of living organisms.
3. It's the type of water added on the samples in microscopes.
4. It's a part of the microscope through which you look at the sample.
5. It's a part of the microscope that changes the magnifying power.

Correct the underlined words:

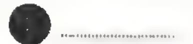
1. A complex living system contains **one cell**.
2. We use drops of **tap** water on the sample in a microscope.
3. We look at the sample through the **objective lens** of the microscope.
4. We change the magnifying power of the microscope by using a different **mirror**.

Cross out the odd word:

1. Objective lens – Stage clips – Eyepiece – Distilled water
2. A leaf cell – A red blood cell – A skin cell – A bird's unfertilized egg cell

Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
● The cell	a. changes the magnifying power of the microscope.
● A compound microscope	b. is the building unit of the living organism's structure.
● Changing the objective lens	c. can be used to examine a thin membrane of an onion.



Unit 1

7 Answer the following questions:

A Study the following three figures that represent the samples under a compound microscope, then put true or false:

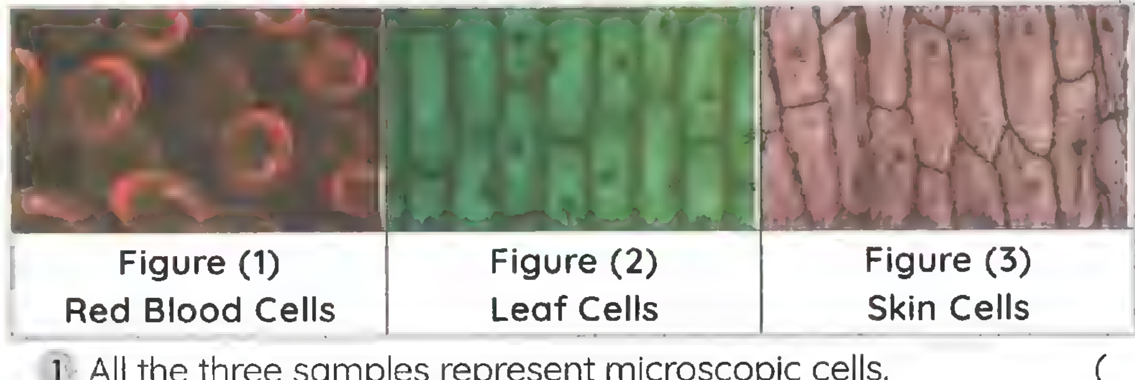


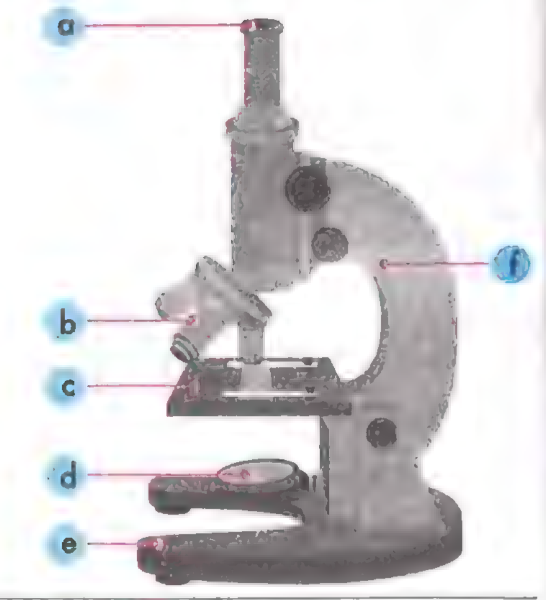
Figure (1)	Figure (2)	Figure (3)
Red Blood Cells	Leaf Cells	Skin Cells

1. All the three samples represent microscopic cells. ( )
2. The three samples have different functions. ( )
3. All the three samples can exist in the same organism. ( )
4. Each figure represents the basic units that form an organism. ( )

B 1. The following diagram represents the ....

2. Write the following labels:

a. ....
b. ....
c. ....
d. ....
e. ....
f. ....



8 Give a reason for:

- The microscope is very important for the biologists and botanists.

....

9 What happens if:

- The microscope wasn't invented?

....





Activity 7 The Parts of a Cell



» Living organisms are classified according to the number of cells into:

1 Unicellular organisms



- They are organisms made up of only one cell.


Ex. Bacteria

- The number of cells in living organisms varies.

2 Multicellular organisms



- They are organisms that have more than one cell.


Ex.

- Complex organisms such as humans, animals and plants.

NOTES:

- **The number of cells in living organisms varies, as follow:**

Human	Animal	Plant
A human has about 40 trillion cells.	An animal has a variety of cell types, including: 1 Muscle cells 2 Bone cells 3 Blood cells	A plant has a variety of cell types that perform photosynthesis or collect water and mineral nutrients.

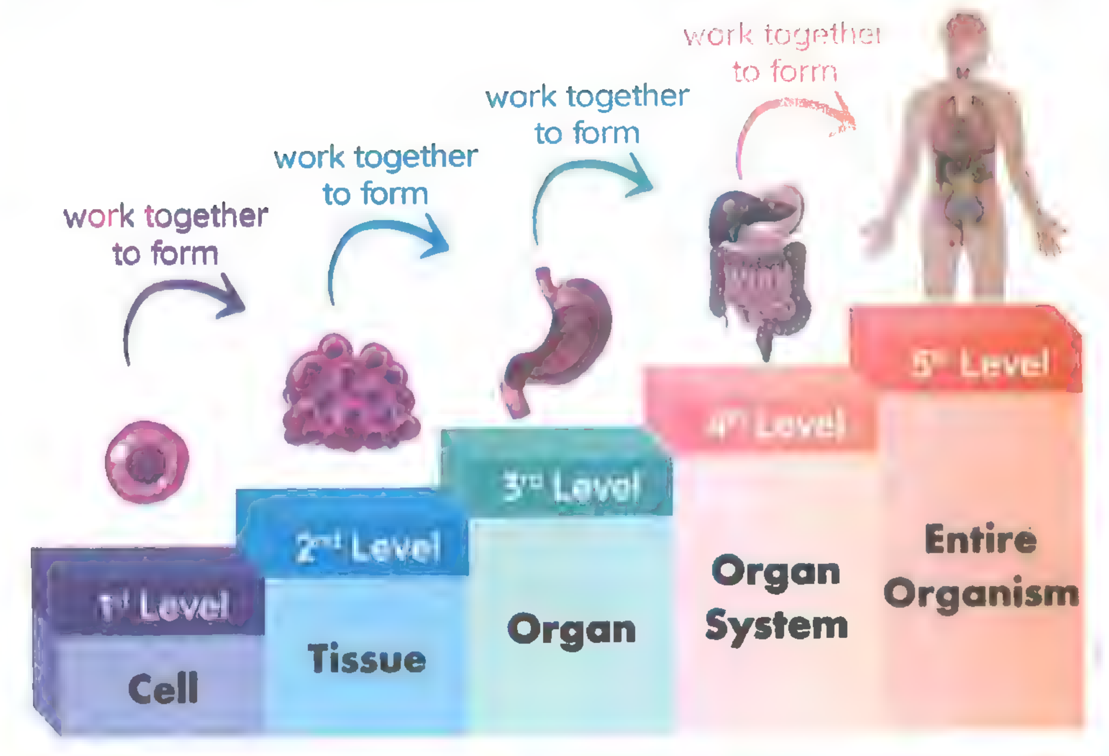
• يختلف عدد الخلايا في جميع الكائنات الحية:

- يملك الإنسان ما يقرب من ٤٠ تريليون خلية.
- للحيوانات مجموعة متنوعة من الخلايا، بما في ذلك خلايا العضلات، وخلايا العظام، وخلايا الدم.
- تقوم الأنواع المتخصصة من الخلايا النباتية بعملية البناء الضوئي، أو تجميع المياه والعناصر الغذائية.

Unit 1

Levels of Biological Organization

» The structure of most multicellular organisms is organized into five levels:



» Each level plays a specific role related to that organism's structure and function.

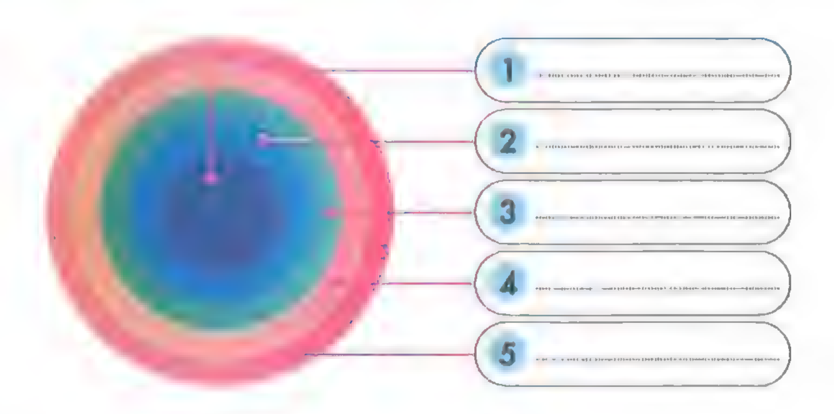
Level	Definition	Examples
Cell	The basic (smallest) unit of life.	Stomach cells
Tissue	A group of similar cells that share a common origin and perform the same function.	Stomach tissues
Organ	A group of tissues involved in performing a particular function.	Stomach
System	A group of organs that perform a specific function.	Digestive system
Entire Organism	A group of systems that work together.	Human



Check your understanding?

1 Complete the following diagram using these words:

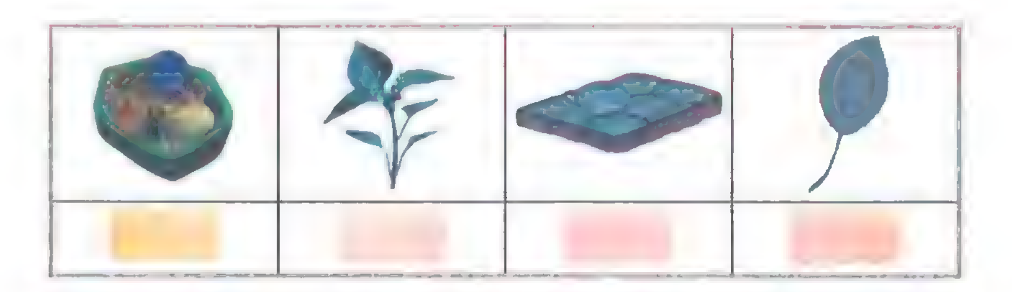
(Circulatory system – Artery cells – Human – Artery tissues – Artery)



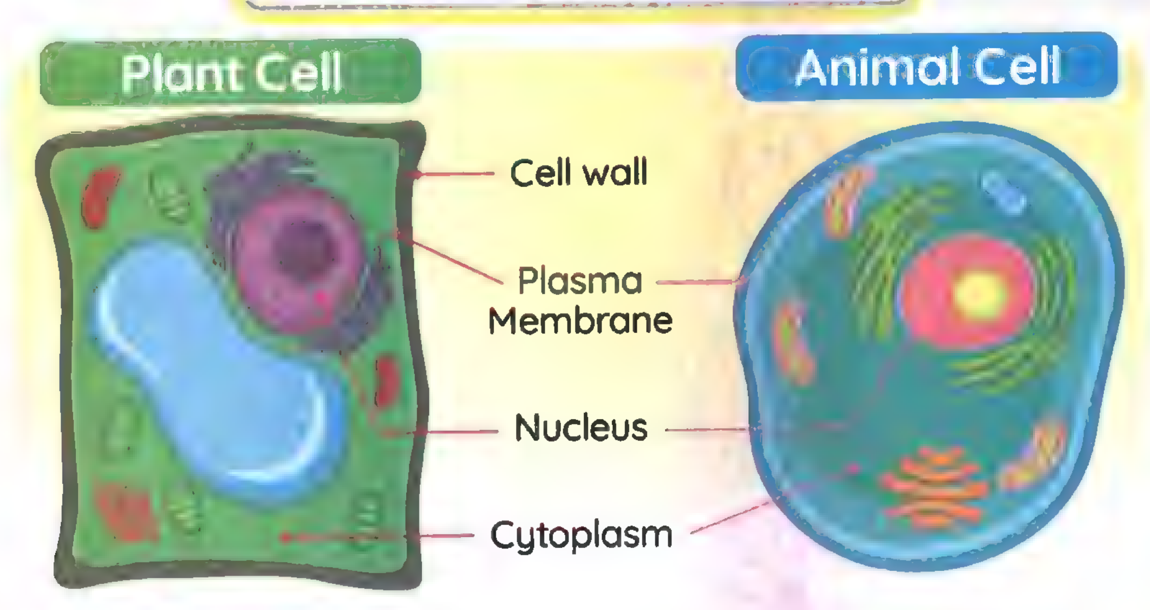
2 Choose the correct answer from the words between brackets:

1. The .... consist(s) of a group of tissues. (heart – blood cells)
2. The cell is the .... unit of life. (biggest – smallest)
3. Both stomach and liver are .... (systems – organs)
4. An organ consists of a group of .... (systems – tissues)

3 Arrange the following images according to the level of organization in a sunflower:



Structure of the Cell



» Now, we are going to study some parts of the cell and their functions:

1 Cell Wall:

Location:	It surrounds the plant cell from outside.
Function:	It is made of cellulose, and it gives the cell a definite shape.

2 Plasma (Cell) Membrane:

Location:	It surrounds the cell (cytoplasm).
Function:	It protects the cell and regulates what can enter or leave it.

3 Nucleus:

Location:	It is located at the center of the cells.
Function:	It is the control center for the organelles.

4 Cytoplasm:

Location:	It is located inside the membrane.
Function:	It supports the organelles.

Organelle • It's a structure within the cell that has a special function.



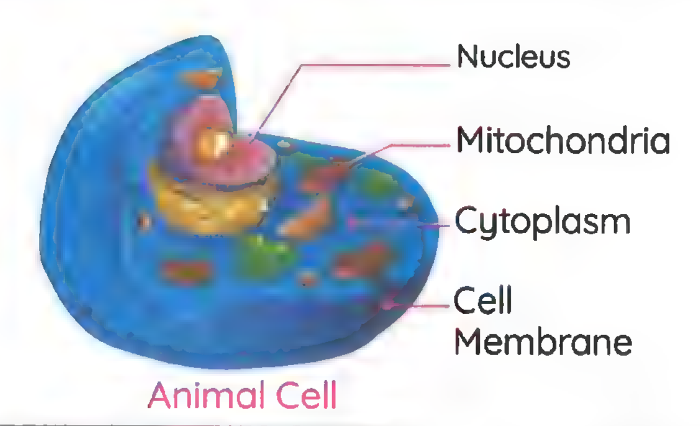
Activity  The Functions of Cell Parts

» Different cells have different structures.

» The cells of multicellular organisms can vary greatly.

Common characteristics:

Most cells have cytoplasm, a cell membrane, a nucleus, and mitochondria.



Animal Cell

Cell Membrane	• It is the outer lining of the cell. • It controls which substances can enter or leave the cell. • It is said to be "selectively permeable" G.R Because some substances can pass through it, while others cannot.
Cytoplasm	• It is the gelatinous liquid inside the cells in which other cell parts float.
Nucleus	• It is responsible for controlling cell activities, such as: 1 Making proteins 2 Cell division

• الغشاء الخلوي:

– هو البطانة الخارجية للخلية. – يساعد على التحكم في المواد التي يمكن أن تدخل إلى الخلية أو تخرج منها.

– يقال إن الغشاء الخلوي: «انتقائي النفاذية»؛ لأن بعض المواد يمكن أن تمر من خلاله، بينما يمنع البعض الآخر.

• السيتوبلازم:

– هو سائل هُلامي داخل الخلايا والذي تطفو فيه مكونات الخلية الأخرى.

• النواة:

– مسئولة عن التحكم في أنشطة الخلية مثل: 1 تكوين البروتينات. 2 الانقسام لتكوين خلايا جديدة.



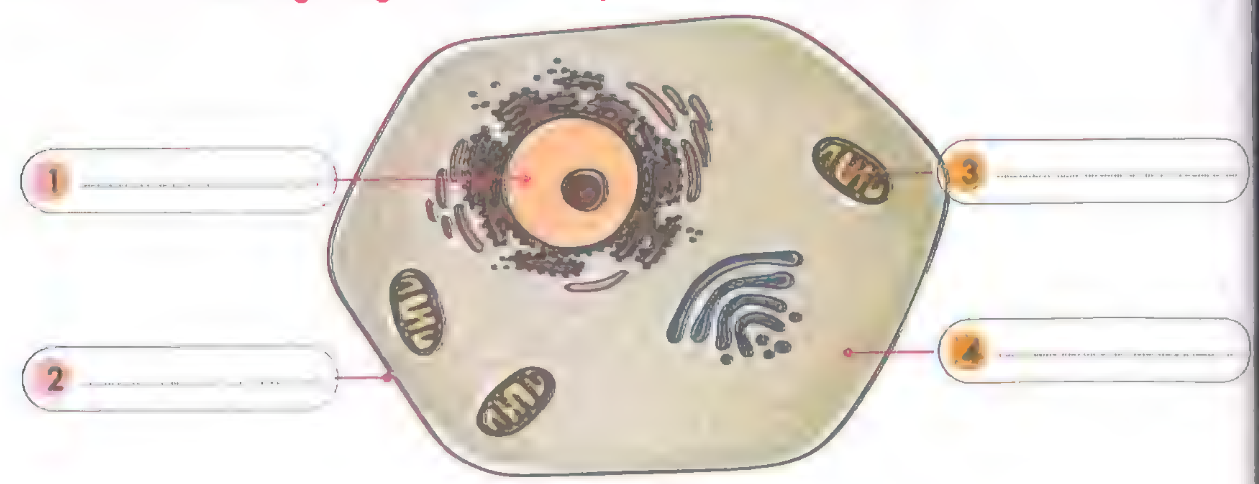
Mitochondria	• They are powerhouses that supply the cell with energy. • Cellular respiration takes place in it. **Cellular respiration:** » It's a process of using oxygen gas to get chemical energy from food, so that the cells can continue to function.

• الميتوكوندريا:
– هي مراكز الطاقة للخلية.
– يحدث التنفس الخلوي في الميتوكوندريا.
• التنفس الخلوي:
– هو عملية استخدام الأكسجين للحصول على الطاقة من الغذاء؛ لتتمكن الخلية من أداء وظائفها.

Check your understanding?



Label the following diagram. Not all parts will be labeled.



Structure of a Human Cell

Exercises on Lesson 3

1 Choose the correct answer:

1. The human body is composed of .... cells.
   a. 40 hundred b. 40 thousand c. 40 million d. 40 trillion
2. All the following are from the cells found in the animal body, except the ....
   a. blood cells b. xylem cells c. bone cells d. muscle cells
3. A/An .... is a unicellular simple living organism.
   a. human b. animal c. bacterium d. plant
4. The tissue is a set of similar ....
   a. systems b. cells c. organs d. organelles
5. All the following are considered organs, except the ....
   a. lung b. heart c. stomach d. muscle tissue
6. The systems that keep a multicellular organism alive are divided into .... levels.
   a. two b. three c. four d. five
7. All the following organelles are common in plants and animals cells, except the ....
   a. cytoplasm b. cell wall c. nucleus d. cell membrane
8. Cell's components are suspended in the ....
   a. nucleus b. cell wall c. cytoplasm d. cell membrane
9. The .... surrounds the plant cell from outside and gives it a definite shape.
   a. nucleus b. cell wall c. cytoplasm d. cell membrane
10. The .... is a liquid that fills the cavity of the cell and is surrounded by the cell membrane.
    a. nucleus b. cell wall c. cytoplasm d. mitochondrion

11 The .... surrounds the cytoplasm and controls the substances that enter or leave the cell.

a. cell wall
b. nucleus
c. plasma membrane
d. mitochondrion

2 Put (✓) or (✗):

1. The number of cells in plants and animals varies from a species to another. (   )
2. A stomach consists of a group of tissues. (   )
3. The liver is a tissue, while the heart is an organ. (   )
4. The respiratory system consists of a set of cells. (   )
5. The cell is the smallest building unit of a living organism. (   )
6. Both the mitochondrion and plasma membrane are found in plant and animal cells. (   )
7. The cell membrane surrounds the plant cell from outside. (   )
8. Nucleus, mitochondria and cell membrane float in the cytoplasm. (   )
9. The outermost layer of the cell is called "cell membrane". (   )

3 Write the scientific term:

1. It is a structure inside the cell that has a specific function.
2. It is a set of tissues forming a structural unit to perform a specific function.
3. It is a group of identical cells that perform the same function.
4. It is a group of organs that perform a specific function.
5. It's a liquid in which the cell's organelles float.
6. It's a feature through which the cell membrane determines which substances will pass through.
7. It's the outer lining of the cell that surrounds the cytoplasm.
8. It's the structure that controls the cell activities.
9. They are the powerhouses of energy in the cell.
10. It's a process of using oxygen to get chemical energy from food in the cell.

4 Complete the following sentences using the words between the brackets:

(cells – similar – nucleus – organelles – tissues)

1. A cell consists of .... that are functioning in .... ways to maintain the cell.
2. An organ is composed of a set of .... that are composed of a group of ....
3. The .... in the cell is responsible for cell division.

5 Correct the underlined words:

1. A system is composed of a set of **tissues** that work together.
2. The stomach and lung are considered **systems**.
3. The liver consists of a group of **organelles**.
4. The **cytoplasm** is the control center of the cell.
5. The **cell wall** is a semi-permeable membrane that controls the substances entering the cell.
6. **Photosynthesis process** takes place inside the mitochondria.
7. The **plant** cell is the building unit of the human body.

6 Cross out the odd word:

1. Cell membrane – Cell wall – Nucleus – Cytoplasm
2. Digestive system – Respiratory system – Circulatory system – Heart
3. Blood cell – Stomach – Lung – Liver

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. Nucleus	a. is the control center of the cell.
2. Cell membrane	b. supports the plant cell from outside.
3. Cell wall	c. controls the substances passing into or out of the cell.

1. .... 2. .... 3. ....

Unit

8 Answer the following questions:

A **Study the following three figures, then answer:**

1. Figure ( ) consists of tissues.
2. Figure ( ) represents a group of cells.

Figure a | Figure b

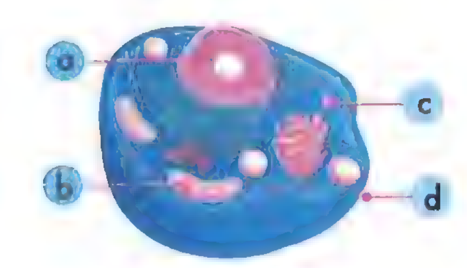
B
1. The following diagram represents the ....
2. Write the following labels:

a ....

b ....

c ....

d ....



9 Give reasons for:

1. All organs of the digestive system work together.

....

2. The cell membrane has the selective permeability property.

....

3. The nucleus has an important role for the cell.

....

4. The mitochondrion has an important role for the cell.

....

10 What happens if:

1. The cell wall in the plant cell is absent?

....

2. The mitochondria are absent from an animal cell?

....

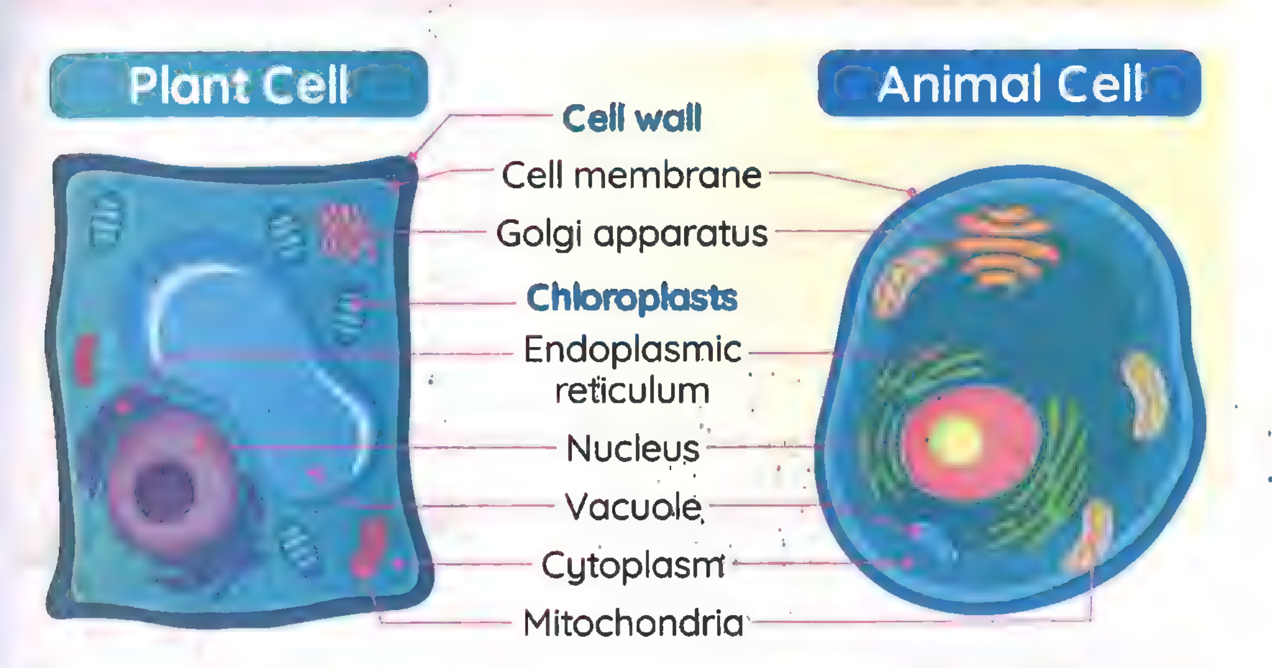






Activity 9 Comparing Plant and Animal Cells

- You know that plant cells and animal cells have similarities and differences.
- Observe the following two figures that represent the structure of each cell.



P.O.C	Animal Cells	Plant Cells
Differences	They don't have a cell wall or chloroplast.	They have a cell wall and a chloroplast.
Similarities	Both of them have common organelles, such as: 1 Cell membrane 2 Cytoplasm 3 Nucleus 4 Mitochondria 5 Endoplasmic reticulum 6 Golgi apparatus 7 Vacuole	

Differences Between Plants and Animals

1 Plants



» Under the microscope, the plant cell has tiny granules.

These granules are green. G.R

- Because they contain the pigment of chlorophyll.



How does the plant make its own food?



1. The pigment chlorophyll absorbs energy from sunlight.
2. The chloroplast uses energy to make food for the plant.

- إذا نظرت إلى الخلية النباتية تحت الميكروسكوب، فيمكنك رؤية أنها تحتوي على حبيبات صغيرة خضراء في أكياس.
- تتكون ورقة النبات من بلاستيدات تحتوي على حبيبات خضراء تسمى «صبغة الكلوروفيل».
- هذه الحبيبات خضراء؛ لأنها تحتوي على «صبغة الكلوروفيل».
- كيف يتمكن النبات من صنع غذائه بنفسه؟

1 تمتص «صبغة الكلوروفيل» الطاقة من ضوء الشمس.
2 تستخدم البلاستيدات الخضراء تلك الطاقة لصنع غذاء النبات.

2 Animals

» Animal cells do not have chloroplasts or a cell wall.

Animals can't make their own food. G.R



- Because they don't have chloroplasts.

Animals do not take on the rigid structures that plants do. G.R

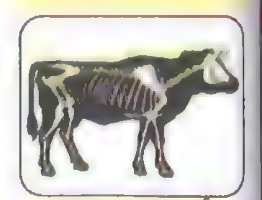


- Because they don't have cell walls.

» Animals have other ways of keeping their shape.

- Some animals have bones.
- Insects have an exoskeleton (a hard, shell-like covering).

Bones in cows



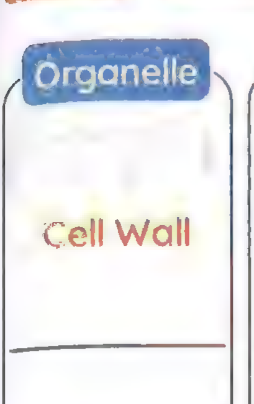
Exoskeleton of insects

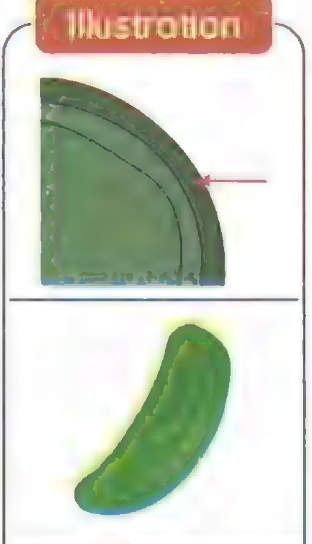


- لا تحتوي الخلايا الحيوانية على بلاستيدات خضراء أو جدار خلوي.
- لا تتمكن الحيوانات من صنع غذائها بنفسها لعدم وجود بلاستيدات خضراء في خلاياها.
- لا تتخذ الحيوانات نفس الهياكل التي تتخذها النباتات؛ لأن الخلايا الحيوانية لا تحتوي على جدار خلوي.
- لدى الحيوانات طرق أخرى للحفاظ على شكلها.
- بعض الحيوانات لديها عظام والبعض الآخر مثل: الحشرات، لها ظهر صلب يشبه الصدفة يسمى «الهيكل الخارجي».



First Different cell organelles:





Organelle	Illustration	Function
Cell Wall		• It is found in the plant's cell only. • It's the rigid outside material that surrounds the plant cells. • It gives them a definite shape.
Chloroplast		• It is found in the plant's cell only. • It contains chlorophyll and carries out the photosynthesis process.

جدار الخلية:

• توجد في النباتات فقط. • هي المادة الخارجية الصلبة التي تحيط بخلايا النبات. • تُعطي النبات شكلًا محددًا.

البلاستيدة الخضراء:

• توجد في النباتات فقط. • تحتوي على مادة «الكلوروفيل» وتقوم بعملية البناء الضوئي.

Check your understanding?



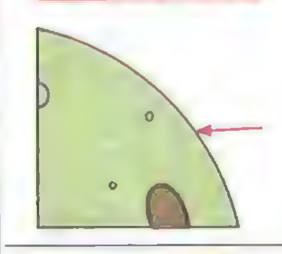
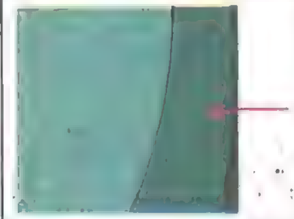
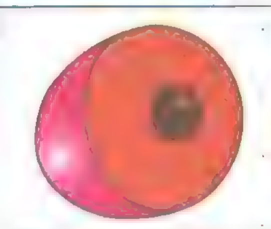
Put (✓) or (✗):

1. Plants and animals have some very similar structures within their cells. ( )
2. Animals can't make their own food because they don't have a cell wall. ( )
3. The vacuole exists in both plant cells and animal cells. ( )
4. Plants have chloroplasts that enable them to make their own food. ( )
5. An animal cell has a definite shape because it has a cell wall. ( )

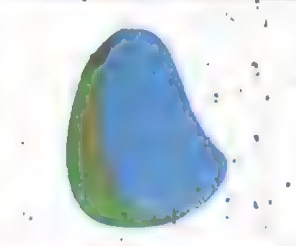


Second Common cell organelles:

- Both plant and animal cells have common organelles to control, organize, and maintain the cell.
- These functions are mainly done by the cell membrane, cytoplasm, cell nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, and vacuole.

Organelle	Illustration	Function
Cell Membrane		• It is the surrounding layer of the cell. • It controls what materials enter and leave the cell.
Cytoplasm		• It is the **gelatinous liquid** inside the cells in which other cell parts float.
Cell Nucleus		• It controls the functions inside the cell, such as: 1 Making proteins 2 Cell division
Mitochondria		• It converts **sugar** into **energy** for the cell.

غشاء الخلية:	• الطبقة المحيطة بالخلية التي تتحكم في المواد التي تدخل إلى الخلية وتخرج منها.
السيتوبلازم:	• هو السائل الهُلامي داخل الخلايا والذي تطفو فيه مكونات الخلية الأخرى.
نواة الخلية:	• تتحكم النواة في الوظائف داخل الخلية مثل: إنتاج البروتين، وانقسام الخلية.
الميتوكوندريا:	• تُحوِّل السكر إلى طاقة للخلية.

Organelle	Illustration	Function
Endoplasmic Reticulum		• It helps in **assembling** and **transporting** proteins.
 Golgi Apparatus		 1 It helps in **preparing**, **packaging** and **transporting** materials within the cell. 2 It helps in **transporting** materials out the cell.
Vacuole		• They are **saclike** structures used for the storage of nutrients, water, and waste. • In plant cells, large vacuoles contain water.

» The vacuole is larger in the plant cell than in the animal cell. 

Because the plant stores a large amount of water in the vacuole.

الشبكة الإندوبلازمية: • تساعد في جمع ونقل البروتينات.

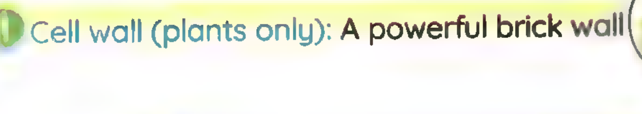
جهاز جولجي: • يساعد على تحضير وتغليف ونقل العناصر الغذائية داخل الخلية.
• يساعد على نقل المواد الغذائية خارج الخلية.

الفجوة العصارية: • تركيب يشبه الكيس ويستخدم لتخزين العناصر الغذائية والمياه والفضلات.
• في الخلايا النباتية، تحتوي الفجوات الكبيرة على الماء.



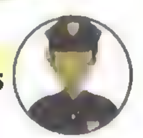
Activity 10 Project: Planning a Cell City

Suppose you are an engineer, and you have been asked to design a cell city model to display different organelles.



1. Cell wall (plants only): A powerful brick wall





2. Cell membrane: Guards at the city gates



3. Nucleus: City hall



4. Mitochondria: Electrical power station



5. Endoplasmic reticulum: Construction workers



6. Vacuole: Storage facility



7. Chloroplast (plants only): Food factory



8. Golgi apparatus: Packaging factory or post office

1 الجدار الخلوي (في النباتات فقط): جدار قوي من الطوب.
2 الغشاء الخلوي: حراس بوابات المدينة.
3 النواة: مجلس إدارة المدينة.
4 الميتوكوندريا: محطة توليد الكهرباء.
5 الشبكة الإندوبلازمية: عمال البناء.
6 الفجوة العصارية: صومعة التخزين.
7 البلاستيدة الخضراء (في النباتات فقط): مصنع الغذاء.
8 جهاز جولجي: مصنع التعبئة أو مكتب البريد.

Exercises on Lesson 4

1 Choose the correct answer:

1. Which of the following is found in both plant and animal cells?
   a. Cell membrane
   b. Cell wall
   c. Large, water-filled vacuole
   d. Chloroplast

2. Which two organelles are involved in transportation?
   a. Nucleus and endoplasmic reticulum
   b. Mitochondria and nucleus
   c. Chloroplast and Golgi apparatus
   d. Endoplasmic reticulum and Golgi apparatus

3. Photosynthesis process takes place in the ...., while cellular respiration takes place in the ....
   a. nucleus – cytoplasm
   b. mitochondria – nucleus
   c. mitochondria – chloroplast
   d. chloroplast – mitochondria

4. .... are unique structures that exist only in the plant cell.
   a. Mitochondria
   b. Nuclei
   c. Vacuoles
   d. Chloroplasts

5. The plant cell is distinguished from the animal cell by the presence of .... and ....
   a. chloroplasts - nucleus
   b. nucleus – cell wall
   c. chloroplasts - cell wall
   d. nucleus – cytoplasm

6. The .... release(s) energy to power the cell.
   a. mitochondria
   b. cell wall
   c. nucleus
   d. cell membrane

7. .... is the command center of the cell.
   a. Chloroplast
   b. Mitochondrion
   c. Nucleus
   d. Cell membrane

8. All the following can be stored in the cell vacuole, except ....
   a. waste
   b. cytoplasm
   c. water
   d. nutrients

9 The .... transports proteins in the cell.
a. Golgi apparatus
b. mitochondrion
c. endoplasmic reticulum
d. nucleus

10 The .... controls the substances that enter or leave the cell.
a. cytoplasm
b. cell wall
c. nucleus
d. cell membrane

11 The envelopes of the cell used for transporting materials are the ....
a. nuclei
b. chloroplasts
c. mitochondria
d. Golgi bodies

12 The .... in the cell resembles the powerful brick wall of a city.
a. nucleus
b. cell wall
c. cytoplasm
d. cell membrane

13 Golgi apparatus can .... inside the cell.
a. transport protein
b. package waste
c. make proteins
d. a and b

Put (✓) or (✗):

1 Both plant and animal cells have common organelles to organize and maintain the cell. ( )
2 Chloroplasts release energy from the food, but mitochondria produce energy from the sunlight. ( )
3 Chloroplasts have yellow grains called chlorophyll pigment. ( )
4 The outermost layer of a plant cell is the cell wall, but the outermost layer in an animal cell is the cell membrane. ( )
5 The animal cell has a definite shape, while the plant cell has an indefinite shape. ( )
6 Golgi apparatus can transport materials inside cells, but it can't transport them outside them. ( )
7 The plant cell has a larger vacuole than that of the animal cell. ( )
8 The cell membrane looks like guards at the gates of a city. ( )

Write the scientific term:

1 They help plant and animal cells control, organize, and maintain the cell. (............)
2 It controls the functions inside the cell and cell division. (............)
3 They are saclike organelles that store nutrients, water, and waste. (............)

4. It's the fluid found in the cell that holds its organelles. (..................)
5. They're organelles in the plant cell that convert light energy into sugar. (..................)
6. They're organelles in the plant cell that power the cell with energy. (..................)
7. It's a process that occurs inside the chloroplast. (..................)
8. It's a process that occurs inside the mitochondria. (..................)

4 Complete the following sentences using the words between the brackets:

(Golgi apparatus – sugar – Mitochondria – chloroplasts – exoskeleton – chlorophyll – Bones – endoplasmic reticulum)

1. .... support(s) the fish body shape, while a /an .... supports that of insects.
2. In the photosynthesis process, ... absorb(s) sunlight, where .... use(s) it to make the plant's food.
3. .... transport(s) proteins produced by the .... through the cell.
4. .... convert(s) .... into energy that is needed for the cell activities.

5 Correct the underlined words:

1. Chloroplasts have a green color due to the presence of **iodine** pigment.
2. A plant cell has a rigid shape due to the presence of the **cell membrane**.
3. Insects have a hard, shell-like support called **an endoskeleton**.
4. Cytoplasm is a **solid** matter that surrounds the cell's organelles.
5. The endoplasmic reticulum helps in the assembly and transport of **fats** in the cell.
6. **The endoplasmic reticulum** is the post office that packages proteins in the cell.

6 Cross out the odd word:

1. Nucleus – Endoplasmic reticulum – Mitochondria – Chloroplasts (..................)
2. Horses – Plants – Dogs – Insects (..................)

Concept 1



7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Mitochondrion	a. is the packaging factory for the cell.
2 Golgi apparatus	b. is the food factory of the cell.
3 Chloroplast	c. resembles the construction worker of a city.
4 Vacuole	d. is the powerhouse of the cell.
5 Endoplasmic reticulum	e. is considered the storage facility of the cell.
6 Nucleus	f. resembles the city hall that controls all the cell activities.

1 .... 2 .... 3 .... 4 .... 5 .... 6 ....

8 Answer the following questions:

A Study the following three figures, then answer:

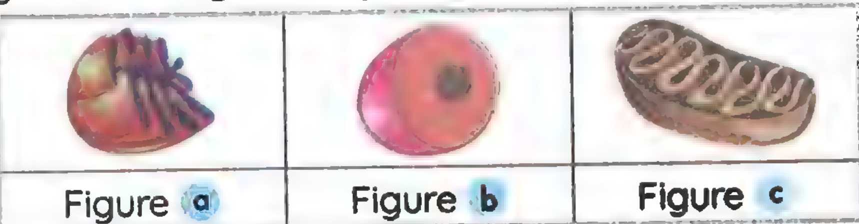


Figure a	Figure b	Figure c

1. Figure (   ) converts sugar into energy.
2. Figure (   ) is considered the protein maker in the cell.
3. Figure (   ) helps in assembling and transporting proteins.

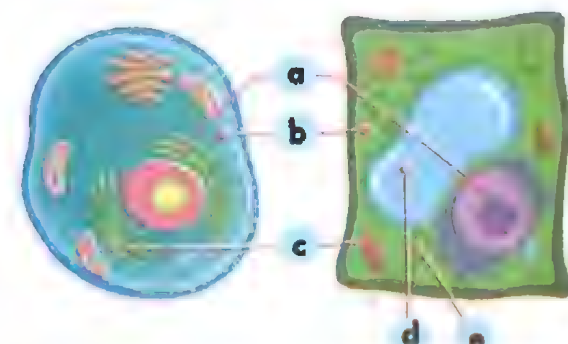
B 1. The following diagrams represent the .... and ....

2. Write the following labels:

a .... b ....

c .... d ....

e ....



3. Mention the function of parts b and d.

....

Give reasons for:

1. Both plant and animal cells have common organelles.
2. Animals can't make their own food.
3. Nucleus is the command center of the cell.
4. The animal cell has an indefinite shape, but the plant cell has a definite shape.
5. Animals can keep their shapes.
6. The vacuole of the plant cell is larger than that of the animal cell.
7. Mitochondria are considered the powerhouse of the cell.
8. The Golgi apparatus resembles the post office of a city.
9. The chloroplasts are the food factories of the cell.
10. Endoplasmic reticulum has an important role in the cell.

What happens if:

1. Chloroplasts in a plant cell are damaged or functioning improperly.
2. Mitochondria stopped converting sugar into energy.
3. The endoplasmic reticulum is absent from the cell.
4. The Golgi apparatus is absent from the cell.
5. The plant has a small vacuole.







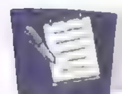
Hands-on Investigation: Build a Cell City

» Observe the following figure that represents a small city, then write the correct number that represents the following organelles:

» Number .... represents the nucleus.
» Number .... represents the cell membrane.
» Number .... represents the cell wall.
» Number .... represents the chloroplast.
» Number .... represents the vacuole.
» Number .... represents the mitochondria.
» Number .... represents Golgi apparatus.
» Number .... represents the endoplasmic reticulum.



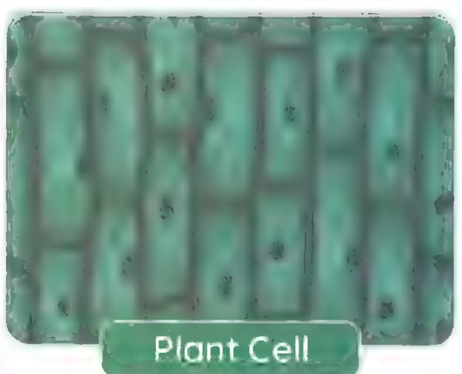






Activity 12 Record Evidence Like a Scientist: The Cell as a System

» Now, you have learned about the cell as a system, look again at Building Blocks of living organisms. You first saw this in Wonder.


Plant Cell

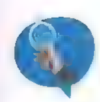

Animal Cell





Question:

» How can you describe Building Blocks of living organisms now?



My Claim:

....

....

Evidence:

....

....

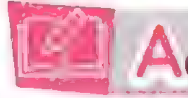


Scientific Explanation:

....

....

STEM in Action



Activity  Careers and Cell Biology



Compound microscopes magnify cells so they seem larger.

» Cells are very tiny. For example:

- The typical animal cell measures about 10 microns, or 0.001 centimeters, in diameter.
- Their internal structures are even smaller.

Cells biologists: They are scientists who study cells by using microscopes in laboratories.

The roles of cell biologists:

1. They study how cells function in living organisms.
2. They conduct experiments and investigate how cells respond to different variables.
3. They analyze data and present their findings to other researchers.
4. Some cell biologists can work with doctors. G.R
   To watch how cells can work to repair body parts or how cells respond to medications.
5. Some cell biologists work in agriculture. 
   To study how plant cells respond to different environmental factors.

• الخلايا صغيرة للغاية، يبلغ قطر الخلية الحيوانية ما يقرب من ١٠ ميكرونات، أو ٠,٠٠١ سم، وتراكيبها الداخلية أصغر من ذلك.

• علماء الخلية: هم علماء يدرسون الخلايا من خلال أجهزة الميكروسكوب المركبة، ويعمل معظمهم في المختبرات، ويتلخص أدوارهم فيما يلي:

1. يدرسون آلية عمل الخلايا في الكائنات الحية.
2. يصممون التجارب ويجرونها، وغالبًا ما يبحثون في كيفية استجابة الخلايا للمتغيرات المختلفة.
3. يحلل علماء الخلايا البيانات ويقدمون النتائج إلى الباحثين الآخرين.
4. يعمل بعض علماء الخلايا مع الأطباء لمراقبة كيفية عمل الخلايا لإصلاح أجزاء الجسم أو كيفية استجابة الخلايا للأدوية.
5. يعمل آخرون في الزراعة، ويدرسون كيفية استجابة الخلايا النباتية لعوامل بيئية مختلفة.

Staining Cells

- Stains (dyes) are used to make the cell's structures more visible under a microscope. G.R
  - Because cells are usually clear and colorless and it is hard to see their structures, even under a microscope.



- Different stains are chosen for different types of cells.
- Some stains highlight specific areas of the cell, for example:
  - Methylene blue dye makes one part of the cells more visible.



- As you look at the image of cheek-lined membrane cells (taken from inside the mouth), notice the blue stain that helps you see the nucleus clearly.

صبغ الخلايا:

- تستخدم الصبغات لإضافة لون ولجعل أجزاء الخلايا أكثر وضوحًا؛ وذلك لأن الخلايا عادة شفافة وعديمة اللون، ويصعب رؤية أجزائها حتى عند فحصها تحت الميكروسكوب.
- يتم اختيار صبغات مختلفة للأنواع المختلفة من الخلايا.
- بعض الصبغات تبرز مناطق معينة من الخلية، مثل:
  - أزرق الميثيلين، متخصص في توضيح جزء واحد من الخلايا.
- عندما تنظر إلى صورة خلايا الخد (عينة تُؤخذ من داخل الفم)، لاحظ الصبغات الزرقاء التي تساعدك على رؤية النواة بشكل أفضل.

Unit 1

Cells in 3D

- Scientists have built a microscope that shows a live cell in 3D.
- This means that scientists can see the top, sides, and layers of a cell.

الخلايا بصورة ثلاثية الأبعاد:

- طور العلماء طريقة أفضل لرؤية الخلايا، فصنعوا «ميكروسكوبًا» يظهر الخلية الحية ثلاثية الأبعاد.
- ما يعني أنه يمكن للعلماء رؤية الخلايا من أعلى، ومن الجوانب، وعلى شكل طبقات.



The importance of seeing cells in 3D:

1. This helps **biologists** learn more about cell parts and how cells divide.
2. This helps **doctors** who treat cancer to offer more help to patients.

   Note: Cancer is caused by cells that divide too quickly.

أهمية رؤية الخلايا بصورة ثلاثية الأبعاد:

1. يمكن أن تساعد هذه التقنية علماء الأحياء على معرفة المزيد عن أجزاء الخلايا وكيفية انقسامها.
2. يمكن أن تساعد الأطباء الذين يعالجون المرضى المصابين بالسرطان.

- مرض السرطان تتسبب فيه الخلايا التي تنقسم بسرعة كبيرة.

How does the 3D microscope work?

1. These new 3D microscopes take pictures of the cell in layers.
2. A computer puts the layers together.
3. Color is then added to the image.

كيفية عمل الميكروسكوب:

1. تلتقط أجهزة الميكروسكوب ثلاثية الأبعاد الجديدة هذه صورًا للخلية في طبقات.
2. يجمع الكمبيوتر تلك الطبقات معًا.
3. ثم يُلون الصورة بعد ذلك.

Exercises on Lessons 5 and 6

1 Choose the correct answer:

1. In a plant cell, which type of city structure would best represent the function of chloroplast?
   a. City hall   b. Food factory   c. Power plant   d. Storage facility
2. If the diameter of an animal cell is 10 microns, then the diameter of its nucleus may be ....
   a. 10 microns   b. 2 microns   c. 10 mm   d. 2 cm
3. Biologists can work with .... to figure out how cells respond to medications.
   a. teachers   b. engineers   c. doctors   d. drivers
4. All the following are from the cell features, except that it is usually ....
   a. very small   b. colorless   c. clear   d. colorful
5. We can see the nuclei in the cheek cells under the microscope using a stain called ....
   a. tap water   b. chlorophyll   c. methylene blue   d. olive oil
6. Studying the .... by cell biologists helps doctors treat cancer.
   a. cell division   b. cellular respiration
   c. photosynthesis process   d. digestion process
7. .... is used to add color and make the cell's structure more visible under the microscope.
   a. Cytoplasm   b. Stain   c. Crayon   d. Tap water

2 Put (✓) or (✗):

1. The typical plant cell measures about 10 microns, or 0.001 centimeters. (   )
2. Cell biologists work in industry to study the plant cells' response to environmental factors. (   )
3. Cell biologists can study the cell by using microscopes in the laboratories. (   )
4. The 2D microscopes take pictures of the cell in layers. (   )
5. The same stain can be used for different types of cells. (   )

6. The pictures taken by the 3D microscope are colorful. (   )

3 Write the scientific term:

1. He/She is the scientist who studies the cell function.
2. It's the place where biologists study cells.
3. It's the stain used to see a specific part of the cell under the microscope.
4. It is used to put images of the cell layers taken by a 3D microscope together.
5. It's a disease caused by the abnormal division of a cell too quickly.

4 Complete the following sentences using the words between the brackets:

(computer – 3D – color – Methylene blue – microscope – cell wall – nucleus)

1. Scientists have built a microscope that shows a live cell in ....
2. The 3D .... takes pictures of the cell in layers that are put together by a ...., then a .... is added to these images.
3. .... is a dye used to see a nucleus in a cheek cell.
4. In a cell city model, the city wall represents the ...., while the city hall represents the ....

5 Correct the underlined words:

1. Stains (dyes) are used to make the cell's structures more <u>invisible</u>.
2. Cancer is caused by the division of a cell too <u>slowly</u>.

6 Give reasons for:

1. It is hard to see the structures of the cell without using stains.

....

2. Cell biologists help doctors to treat cancer.

....

7 What happens if:

- A cell in the human body divides too quickly.

....

Model Exam 1

Question 1

(A) Choose the correct answer:

1. The .... controls the substances that enter or leave the cell.
   a. cell wall b. cell membrane c. cytoplasm d. nucleus
2. .... was the first scientist to use the word "cell".
   a. Newton b. Hooke c. Edison d. Einstein
3. .... are the powerhouses of the cell that convert sugar into energy.
   a. Chloroplasts b. Vacuoles c. Mitochondria d. Golgi bodies
4. The .... directs all the activities of the cell, as cell division and producing protein.
   a. cell wall b. cell membrane c. cytoplasm d. nucleus

(B) Write the scientific term:

- It's a process that takes place in the chloroplast. (....................)

Question 2

(A) Put (✓) or (✗):

1. Both plant and animal cells have same size vacuoles. ( )
2. Methylene blue is a type of dye that is used to view a cell's specific organelle clearly. ( )
3. The microscope has only one magnifying power. ( )
4. Photosynthesis process is an opposite process of the cellular respiration. ( )

(B) Cross out the odd word:

- Plants – Bacteria – Animals – Humans

Question 3

(A) Complete the sentences with the words between brackets:

(endoplasmic reticulum – chlorophyll pigments - vacuoles - Golgi apparatus)

1. Chloroplasts contain green grains called ....
2. The .... transport(s) proteins produced by .... through the cell.
3. The .... store water, nutrients and waste inside them.

(B) What happens if: Too much water enters the cell.

Model Exam 2

Question 1

(A) Choose the correct answer:

1. The .... is the building unit of a living organism's body.
   a. brick b. cell c. organ d. blood
2. The .... is found in the plant cell, but it is absent in the animal cell.
   a. cell membrane b. cell wall c. nucleus d. cytoplasm
3. The .... is a liquid inside the cell that surrounds the organelles.
   a. cytoplasm b. cell wall
   c. nucleus d. endoplasmic reticulum
4. If the diameter of an animal cell is 10 microns, then the diameter of its nucleus may be ....
   a. 10 microns b. 2 microns c. 10 mm d. 2 cm

(B) Give a reason for:

- Mitochondria are considered the powerhouses of the cell.

Question 2

(A) Put (✓) or (✗):

1. The living organism grows and reproduces by increasing the size of its body cells. (   )
2. The microscope helps us to see a very small cell as a bird's unfertilized egg. (   )
3. The cell wall has the selective permeability feature. (   )
4. Cancer is caused by the rapid division of a cell in the human body. (   )

(B) Write the scientific term:

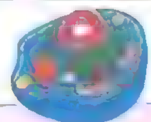
- It's a vital process through which the cell uses oxygen gas to get the needed energy from the food. (....................)

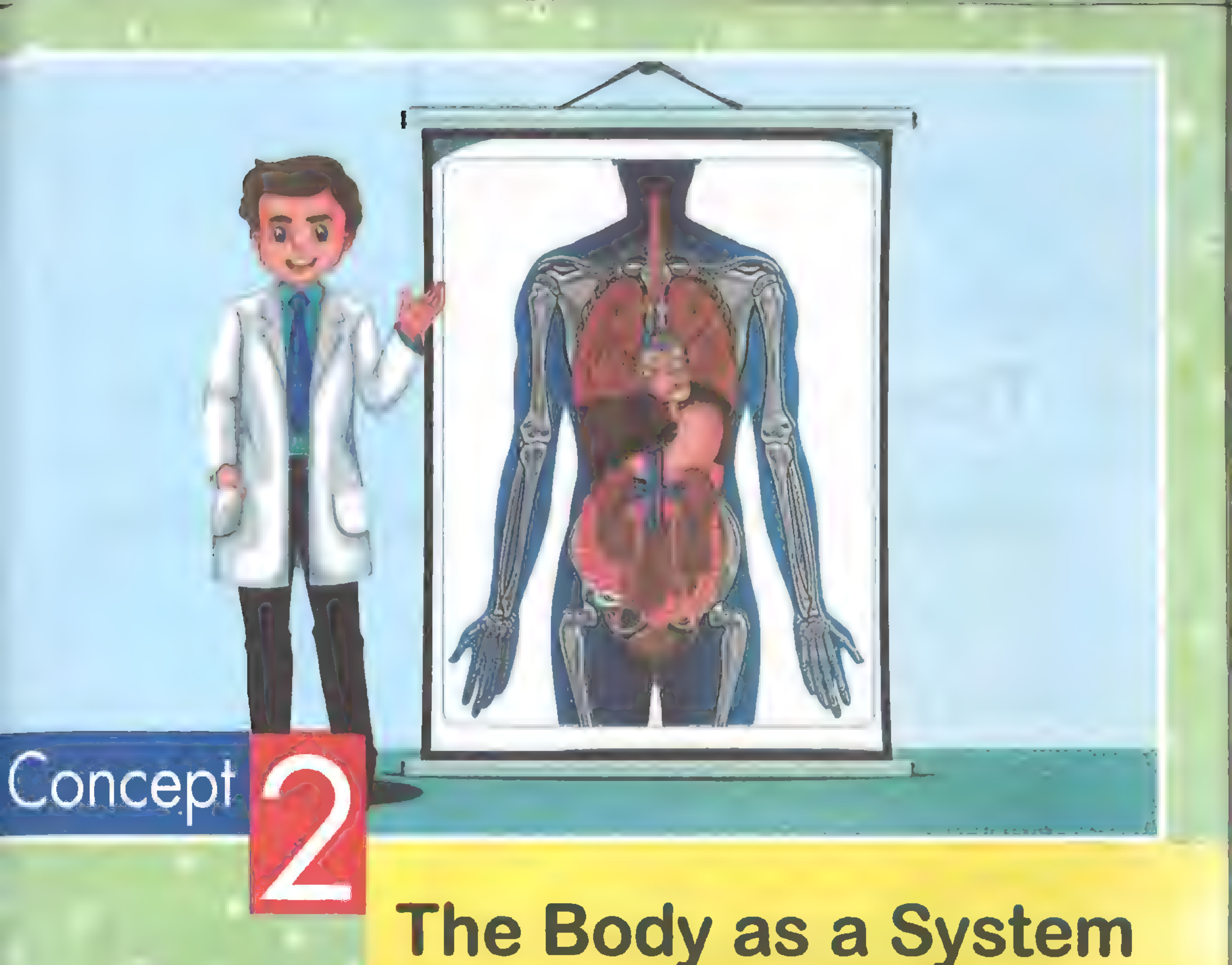
Question 3

(A) Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. Tissue	a. converts sunlight into sugar in photosynthesis process
2. Golgi apparatus	b. controls all cell activities.
3. Chloroplast	c. consists of a group of similar cells.
4. Nucleus	d. packages and transports proteins in the cell.

(B) The opposite diagram represents the ....





Concept 2

The Body as a System

Concept Objectives:

By the end of this concept, students will be able to:

- Create a model to demonstrate understanding of the relationship between cells, tissues, organs, and systems.
- Collect evidence that shows that the excretory system is an example of the coordination among multiple body systems.
- Describe interactions among body systems to explain how they contribute to the overall function of the body.
- Argue from evidence that the body is a system of interacting subsystems composed of groups of cells that form tissues and organs.

Key Vocabulary:

- Pancreas
- Bladder
- Excretory system
- Circulatory system
- Gallbladder
- Gland
- Contract
- Kidney
- Tissues
- Digestion
- Lungs
- Urethra
- Muscle
- Urinary system
- Endocrine system
- Musculoskeletal system
- Nephron

Concept 2

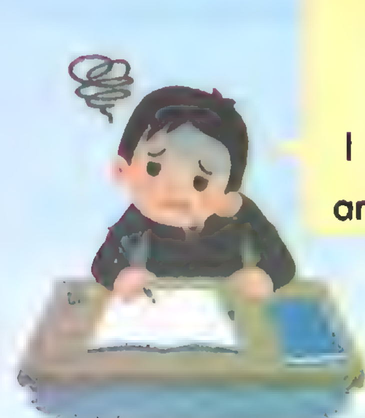
The Body as a System





Activity 1 Can You Explain?

» What happened to your body when you were nervous while taking a test?



When I was nervous,
my heart raced,
I got chills,
I started to perspire,
and my stomach hurt.

• ما الذي يحدث داخل [illegible]

- عندما أشعر بالتوتر، تتسارع نبضات قلبي ويقشعر جسمي، وأبدأ في التعرق، وأشعر بألم في معدتي.

Which system was involved when your heart was beating quickly?

» The circulatory system.

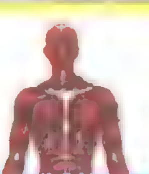
How do organ systems work together as one whole body system?

» The brain is a part of my nervous system, so when I got nervous, my nervous system must have interacted with my circulatory system.

The Body as a System


▲ Skeletal system


▲ Respiratory system


▲ Muscular system


▲ Circulatory system


▲ Digestive system


▲ Nervous system

- Each system has a specific job.
- All body systems work together in harmony to keep humans alive.

Examples of systems that work together:

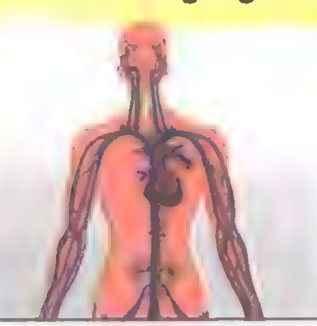
Digestive System

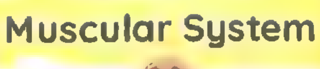


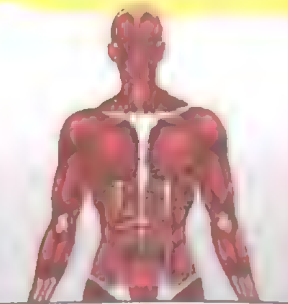


1. The digestive system provides nutrients **for** the muscular system to grow and repair itself.

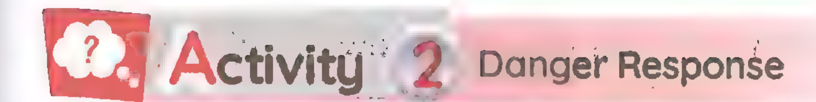
Circulatory System







2. When I'm nervous, my heart beats faster **to** encourage the muscles of my body to move faster.



» The sympathetic nervous system is a part of the nervous system that is responsible for controlling involuntary body functions, such as heartbeat and breathing.

• الجهاز العصبي السمبثاوي هو جزء من الجهاز العصبي، وهو المسئول عن التحكم في وظائف الجسم اللاإرادية مثل: ضربات القلب وضغط الدم ومعدل سرعة التنفس.

» When you are stressed,

the sympathetic nervous system is activated, then stimulate the adrenal glands which causes a number of changes in the body, including an increase in:

1 Heart rate 2 Blood pressure 3 Breathing rate



• عندما تكون متوترًا ينشط الجهاز العصبي السمبثاوي ويحفز غدة الأدرينالين على حدوث بعض التغيرات في الجسم مثل: زيادة ضربات القلب، وضغط الدم، ومعدل سرعة التنفس.

» **How do body systems work together to produce physical responses?**

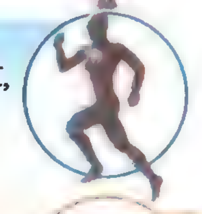
When my eyes see danger,



1 My brain sends a signal to my muscles to begin responding to the threat.



2 My muscles use energy to contract, which causes my body to move.



3 I move so that I can fight or flight from the dangerous situation.

• ماذا يحدث عندما ترى عيناي موقفًا خطيرًا؟

1 يرسل المخ إشارة للعضلات لبدء الاستجابة للتهديد. 2 تستهلك العضلات طاقة في عملية الانقباض؛ مما يجعل جسمي يتحرك.

3 أنا أتحرك لأكون قادرًا على الهرب أو مواجهة الخطر.





• Eyes and brain are parts of the nervous system.




What Is a System?

Activity 3 What Do You Already Know About the Body as a System?

- The nervous system directly controls various organs of the body.
- The brain receives information from many organs of the body and signals these organs to maintain proper functioning.
- The skeletal system allows us to move when our muscles contract.

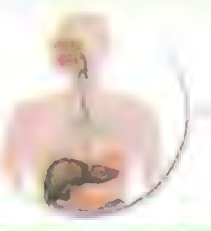
- يتحكم الجهاز العصبي في العديد من أعضاء الجسم بشكل مباشر.
- فالمخ يستقبل المعلومات من العديد من أعضاء الجسم، ويرسل إشارات إلى هذه الأعضاء للقيام بوظائفها المحددة.
- يساعد الجهاز الهيكلي أجسامنا على الحركة عند انقباض العضلات.

The Interaction Between Systems

The nervous system depends on other body systems functions:

For example, nerve cells need nutrients

The Digestive System	The Circulatory System	The Nervous System
The nutrients enter the body as food that is broken down by the digestive system.	The nutrients are transported to nerve cells by the circulatory system.	The nerve cells use nutrients to perform their function.





Check your understanding?



The movement of an arm to pick up a glass of water requires many events. Use the words from the word bank to complete each sentence in the paragraph.

(arm - brain - eyes - heart)

1. To pick up a glass of water, the .... first see the location of the glass on the table.
2. The .... then coordinates the needed movement and sends instructions to the muscles.
3. The .... pumps more blood to feed the muscles required for movement.
4. Muscles in the .... then contract to move toward the water.

Exercises on Lesson 1

1 Choose the correct answer:

1. The .... system provides nutrients for the skeletal system to grow and repair itself.
   a. nervous   b. digestive   c. urinary   d. reproductive
2. When you get nervous, there's an interaction between your .... and .... systems.
   a. circulatory - urinary   b. skeletal - urinary
   c. nervous- urinary   d. nervous – circulatory
3. All the following are emergency situations, except being ....
   a. stressed   b. nervous   c. sleeping   d. scared
4. When you are stressed out, your .... isn't affected.
   a. heart rate   b. breathing rate   c. blood pressure   d. bones' size
5. When your eyes see danger, they send a signal to your ....
   a. muscles   b. brain   c. stomach   d. lungs
6. The eyes and brain are parts of the .... system.
   a. skeletal   b. urinary   c. nervous   d. circulatory
7. The .... pumps more blood to feed the body muscles to move.
   a. heart   b. brain   c. stomach   d. lung
8. To pick up a glass of water, the brain sends a signal to the muscles of your.................... to move.
   a. stomach   b. arm   c. eyes   d. nose
9. All the following may occur while being nervous, except ....
   a. perspiring   b. the increase in heart rate
   c. calming down   d. stomach aches

2 Put (✓) or (✗):

1. Your heart calms down when you feel nervous. (   )
2. The heartbeats in the circulatory system accelerate when feeling afraid. (   )
3. When you start to run faster, there's an interaction between your heart and muscles. (   )
4. While taking a test, you may feel nervous and chilled out, and you may start to perspire. (   )

5. The sympathetic nervous system controls voluntary motion. ( )
6. The brain does not respond when feeling stressed. ( )
7. During danger, your breathing rate increases. ( )
8. Muscles don't need energy to contract. ( )
9. The heart coordinates the needed movements and sends instructions to the muscles. ( )
10. Every system in the body works individually when exposed to danger. ( )

3 Write the scientific term:

1. The system that stimulates the adrenal gland when feeling stressed.
2. The system that provides the body with nutrients.
3. The system that is activated in response to acute stress.
4. A type of glands that are stimulated during stress.
5. An organ that sends a signal to the muscles to begin responding to any threat.
6. The system that allows us to move when our muscles contract.
7. The system that is responsible for transporting nutrients to the muscles cells.
8. The system that breaks down food to get nutrients.
9. The system that controls the muscles of your heart and stomach.

4 Complete the following sentences using the words between the brackets:

(nutrients – adrenal – physiological responses – sympathetic nervous system – heart rate)

1. In a dangerous situation, your body systems interact to produce ...., such as the increase of ....
2. Nerve cells need .... to do their work.
3. During acute stress, the .... system is activated, then stimulates .... glands.

5 Correct the underlined words:

1. Your heart rate <u>decreases</u> during an emergency situation.
2. <u>Thyroid</u> glands are stimulated when feeling stressed.
3. The <u>circulatory</u> system allows us to move when our muscles contract.

6 Mention the function of the following:

1 The digestive system
2 The skeletal system

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Adrenal glands	a. are carried by circulatory system to all body parts.
2 Digestive system	b. supplies body muscles with nutrients.
3 The brain	c. causes an increase of the heartbeats during stress.
4 Nutrients	d. is an organ of the nervous system.

1 .... 2 .... 3 .... 4 ....

8 In the following figures, complete the steps occurring to pick up a glass of water:

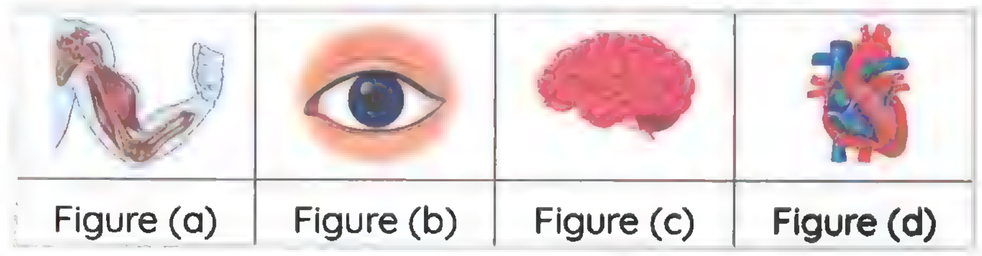


Figure (a) Figure (b) Figure (c) Figure (d)

1 Figure (..........) sees the location of the glass.
2 Figure (..........) sends a signal to figure (..........) to contract and move toward the glass.
3 Figure (..........) pumps more blood to feed the muscles.

9 Give reasons for:

1 All body systems work together in harmony.
2 The digestive system is important for the body's muscles and nerve cells.
3 The skeletal system can't do its job without muscles.
4 Your heart pumps more blood to your muscles while running.
5 The digestive and circulatory systems depend on the nervous system to function.

10 What happens if:

1 You feel nervous while taking a science test?
2 Your body's muscles don't get nutrients?
3 Your arm muscles contract?



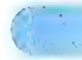




Activity 4 Building Living Systems

Tick (✓) on the correct answer:

1. All living organisms are made up of ....



bricks　　cells

2. The cells inside humans are .... in shape and size.



similar　　different

How can something so small create a much larger organism?

» Although the cell is too small, it can be organized with other cells to create larger systems and build up the human body.

are bundled together to form　　are bundled together to form　　are bundled together to form　　works with other systems in the



Muscle cells



Muscle tissue



Muscle (an organ)



Muscular system



Human body

» Although cells have things in common, they have different shapes and sizes.

Cells have a variety of shapes and sizes.



- Because cells must be specialized to perform specific functions.

- معظم الكائنات الحية عديدة الخلايا، تتكون من أجزاء متعددة لها تراكيب مختلفة.
- على الرغم من أن الخلايا تشترك جميعًا في أشياء محددة، إلا أنه يوجد منها العديد من الأشكال والأحجام.
- ما سبب تنوع شكل الخلايا وحجمها؟
  - هو أن الخلايا يجب أن تكون متخصصة لأداء وظيفة محددة.

Concept 2

Cells to Tissues

For example, Muscle Cells



[1] Muscle cells need to be shaped like long fibers. G.R

- To allow the movement.
- To be able to store and use energy quickly.

[2] Muscle cells do not work alone. G.R

- Because each cell is very small and must work with hundreds of thousands of other cells to be effective.

> Muscles:
> They are bundles of long fibers that allow movement.

• الخلايا العضلية:

[1] الخلايا العضلية يجب أن تكون على شكل ألياف طويلة لتسمح بالحركة، كما يجب أن تكون قادرة على اختزان وإطلاق الطاقة بسرعة.

[2] لا تعمل خلايا العضلات بمفردها، فحجم الخلية العضلية صغير للغاية ويجب أن تعمل مع مئات الآلاف من الخلايا الأخرى لتكون فعّالة.

Tissues to Organs

» An organ consists of group of tissues.

Organ • It is a part of an organism that has a specific job to do.

» In a muscle,

- The muscle cells are bundled together to form tissues.
- Bundles of tissues are organized together to form a muscle.

• أنسجة الأعضاء:

– يتكون العضو من مجموعة من الأنسجة.

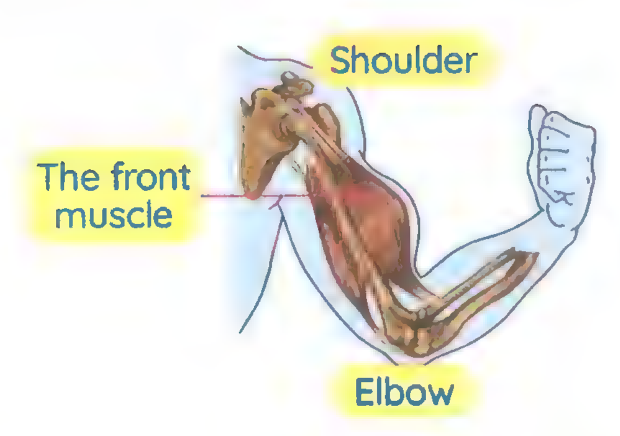
– العضو: يعتبر جزء من نظام يؤدي وظيفة محددة.

• تتجمع الخلايا العضلية معًا لتكوين أنسجة.

• تنتظم الحزم لتشكل العضلة التي تعتبر عضوًا.

What Is a System?

Example: The muscle that is on the front part of your upper arm, between your elbow and your shoulder.



• العضلة: هي التي تقع في مقدمة الجزء العلوي للذراع بين المرفق والكتف.

Organs to Systems

- There are many organs in the body.
- Most organs work as part of a larger, interconnected system.

The system • It is a group of organs that work together to do a specific job in the body.

Musculoskeletal System

It is the system that consists of a group of organs such as bones, muscles, ligaments, and tendons, and cartilages.

Skeletal System

Muscular System

- Each organ of the musculoskeletal system's organs is responsible for its own specific role, but all of these organs contribute to performing the system's job.

• يوجد العديد من الأعضاء في الجسم. • معظم الأعضاء تعمل كأجزاء من نظام.

• الجهاز: هو مجموعة من الأعضاء التي تعمل معًا لتقوم بوظيفة محددة في الجسم.

• الجهاز العضلي الهيكلي: يتكون من مجموعة من الأعضاء مثل: العظام، العضلات، الأربطة، الأوتار والغضاريف.

• كل عضو في الجهاز العضلي الهيكلي له وظيفته الخاصة، ولكن كل هذه الأعضاء تساهم في أداء وظيفة الجهاز.

Systems for a Whole Body

- A system can't work separately to keep the organism alive.
- Most simple tasks that you do every day require many systems to work together at the same time.
- For example:

When you play football, it requires a collaboration between:

- Respiratory system
- Circulatory system
- Nervous system
- Muscloskeletal system
- Execratory system

• النظام لا يمكن أن يعمل منفردًا للحفاظ على حياة الكائن الحي.
• العديد من المهام البسيطة التي تؤديها يوميًا تتطلب أجهزة عديدة للعمل معًا في نفس الوقت.
• عندما تلعب بكرة القدم، يتطلب هذا التعاون بين الجهاز التنفسي والجهاز الدوري والجهاز العصبي والجهاز العضلي الهيكلي وجهاز الإخراج.

Check your understanding?

Put true or false:

- A muscle is considered as an organ. (   )
- Muscles are bundles of long fibers that allow movements. (   )



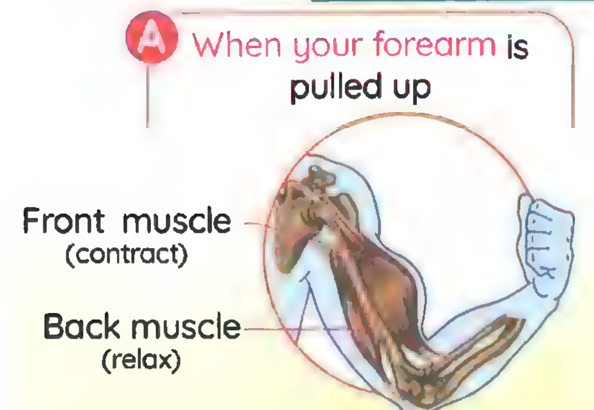
Activity  Moving Muscles

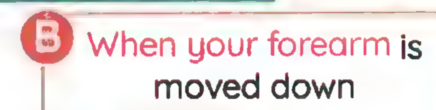
» Let's do a simple activity to learn how the body systems work together.

1. Make a fist.
2. Now bend your elbow.
3. Then lift your fist toward your shoulder.
4. Take your opposite hand and feel your muscles along your arm as you repeat this movement.

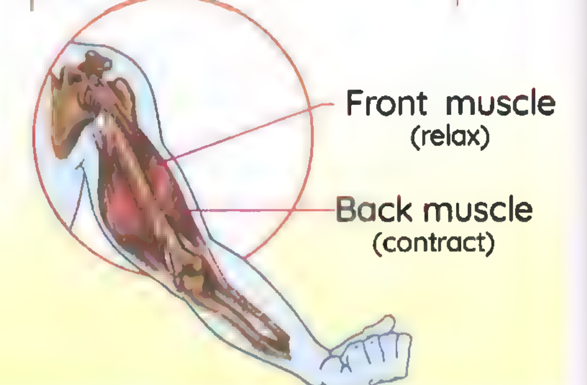
How do the muscles move?

A When your forearm is pulled up





B When your forearm is moved down





- The skeletal muscles cause bones to move.
- A muscle can only exert force when it contracts (shorten in length) to move a bone in just one direction.

You can move your fingers, legs, arms, and other body parts. 

- Due to the contraction and relaxation of the skeletal muscles.

• لنقوم بنشاط بسيط لنعرف كيف تعمل أجهزة الجسم معًا:

ضم قبضة يدك، واثن مرفقك وارفع قبضتك نحو كتفك. قرب يدك الأخرى وتحسس حركة عضلات ذراعك أثناء تكرار هذه الحركة.

• كيف تتحرك العضلات؟ – عندما نسحب الساعد إلى أعلى تنقبض العضلة الأمامية، وتنبسط العضلة الخلفية.

– عندما نحرك الساعد إلى أسفل تنبسط العضلة الأمامية، وتنقبض العضلة الخلفية.

• لاحظ : – العضلات الهيكلية تسبب حركة للعظام.

– تبذل العضلة جهدًا عند انقباضها أو تقليص طولها، ويعمل انقباض العضلات على تحريك العظام في اتجاه واحد فقط.

Exercises on Lesson 2

1 Choose the correct answer:

1. Which of the following is in order from the most complex to the simplest?
   a. Cell, tissue, organ, organ system
   b. Tissue, cell, organ system, organ
   c. Organ system, organ, tissue, cell
   d. Organ system, tissue, cell, organ
2. .... are made of long fibers to store and release energy to allow movement.
   a. Bones b. Muscles c. Blood cells d. Joints
3. A group of similar cells are organized together to form a/an ....
   a. system b. organ c. tissue d. organelle
4. A/An .... consists of a group of tissues.
   a. system b. organ c. cell d. organelle
5. A/An .... is a group of organs that work together to do a specific job in the body.
   a. cell b. tissue c. system d. organelle
6. A muscle can only exert a force when it ....
   a. contracts b. shortens in length
   c. stops moving d. a and b
7. The musculoskeletal system consists of ....
   a. muscles b. bones c. tendons c. all the previous

2 Put (✓) or (✗):

1. A muscle is a bundle of short fibers that allow movement. ( )
2. A muscle can store energy, but it can't use it. ( )
3. The muscular system is the only system that you use while running. ( )

4. The cells of a multicellular organism have different shapes and sizes. ( )
5. A tissue is composed of a group of organs. ( )
6. Muscle cells can work individually to allow movement. ( )
7. A muscle contracts to move a bone in only one direction. ( )

3 Write the scientific term:

1. A bundle of long fibers that can contract to allow movement.
2. It is a group of organs that work together to do a specific job in the body.
3. It is the system that consists of a group of organs, such as bones, muscles, ligaments, tendons, and cartilages.
4. The type of muscles that cause a bone to move.

4 Complete the following sentences using the words between the brackets:

(organ – skeletal – contracts - front - bone – force – one)

1. Muscles exert a .... on bones when they contract.
2. The contraction of a muscle moves a .... in .... direction(s).
3. The .... is a part of of an organism that has a specific job to do.
4. The .... muscles cause movement when they contract.
5. When you lift your fist towards your shoulder, the .... muscle of your upper arm ....

5 Correct the underlined words:

1. Skeletal muscles work with <u>blood</u> to allow movement.
2. When a muscle <u>relaxes</u>, it shortens in length.
3. An organ consists of a group of <u>systems</u>.

6 Cross out the odd word:

- Tendons - Ligaments - Blood - Cartilages

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 A tissue	a. is a bundle of long fibers that contract quickly.
2 A muscle	b. Is organized and bundled together to form a tissue.
3 Group of cells	c. is made up of group of tissues.
4 An organ	d. is made up of similar cells.

1 .... 2 .... 3 .... 4 ....

8 Give reasons for:

1. The cells of a multicellular organism are different in shape and size.

   ....

2. Our body's bones depend on skeletal muscles to move.

   ....

3. Muscle cells need to be shaped like long fibers.

   ....

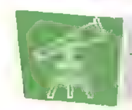
4. We can move our different body parts.

   ....

5. Muscles need to store energy.

   ....

Lesson 3



Activity  Mighty Muscles

» You have learned that muscles must contract and relax to allow for movement.

There are two types of muscles:

 Involuntary muscles

 Voluntary muscles (Skeletal muscles)

 Involuntary Muscles

They are muscles that have an automatic movement that you can't control.

• Examples of involuntary muscles:

1 Heart Muscle:




Heart muscle

- The heart muscle contracts and relaxes without any rest.
- **The heart pumps blood through your body.** G.R
  To send oxygen to your cells with each heartbeat.

2 Eyelid Muscle:

Eyelid muscle

- The eyelid muscle contracts when you close your eyelid.
- You blink about 10 times a minute without even thinking about it.



NOTES:

• There are other involuntary movements in your body, such as:

1. Movement of food through the different digestive system parts (esophagus, stomach, and intestines)
2. Movement of blood through out your body.

• العضلات اللاإرادية: هي عضلات حركتها تلقائية ولا يمكن التحكم فيها، مثل:

1| **عضلة القلب:** – تنقبض وتنبسط بدون توقف.

– مع كل نبضة يضخ القلب الدم في كل أجزاء الجسم، حاملًا الأكسجين إلى كل خلية.

2| **عضلة العين:** تنقبض عضلة العين عند إغلاق جفن العين.

• ترمش عيناك عشر مرات في الدميقة بدون تفكير.

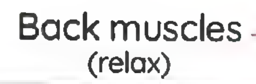
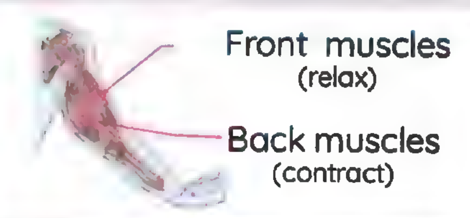
• There are other muscles surrounding the eyeballs to help move your eyes in different directions.

2 Voluntary Muscles

They are the skeletal muscles with which you can control their movement.

1 Arm Muscles:

» Bending your elbow takes the action of two different voluntary muscles.

When you bend your arm	When you straighten your arm
Front muscles (contract) Back muscles (relax) 	 Front muscles (relax) Back muscles (contract)
The muscles in the front of your upper arm contract, while the muscles in the back of your arm relax.	The muscles in the back contract while the muscles in the front relax.

- عند ثني الذراع تنقبض العضلة الأمامية، بينما تنبسط العضلة الخلفية.
- عند فرد الذراع تنبسط العضلة الأمامية، بينما تنقبض العضلة الخلفية.

Skeletal muscles

They are the muscles that move the body's bones.

2 Forearm Muscles:

» When you turn your hand over, it takes the action of two important voluntary muscles in your forearm.

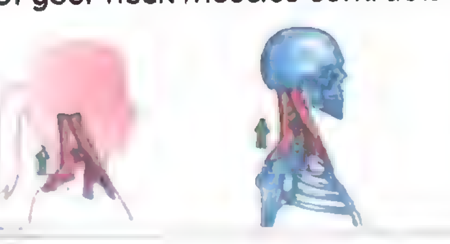
When you palm facing up,	When you palm facing down,
One of your forearm muscles contracts.	 Two muscles contract.

- عندما تدير راحة يدك، تعمل عضلتان أساسيتان بشكل إرادي في ساعدك.
- تنقبض إحداهما عندما تكون راحة يدك لأعلى، بينما تنقبض الأخرى عندما تدير راحة يدك إلى أسفل.

3 Neck Muscles:

» Two important neck muscles work when you move your head up and down.

When you lift your head up	When you pull your head down
One of your neck muscles contracts.	The other muscle contracts.







• تعمل عضلتان هامتان في الرقبة عندما ترفع رأسك لأعلى أو تخفضها لأسفل.

– عندما ترفع رأسك لأعلى أو تخفضها لأسفل: تنقبض إحداهما أثناء رفع رأسك، بينما تنقبض الأخرى أثناء خفض رأسك.

4 Abdomen Muscles:

» On each side of your body, you have two important abdominal muscles (abdominals).

» When you twist your body to one side,

- The two muscles on that side contract together.
- The two muscles on the other side relax together.

• لديك عضلتان مهمتان في البطن على جانبي الجسم تسميان بعضلات الخصر.

• عندما تدير خصرك لأحد الجانبين، تنقبض العضلتان على هذا الجانب معًا، بينما تنبسط العضلتان على الجانب الآخر.



- There are other voluntary movements in your body, such as:

1. Movement of the jaw's muscles to move teeth to chew food.
2. Movement of muscles in your limbs as fingers, arms, and legs that help you to move them.



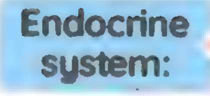
Activity  Systems Work Together

- The body systems work together to help your body face danger.
- Your body has a physical reaction to stress or danger.
- One way to describe this collection of symptoms is called "fight or flight"

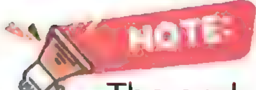
Endocrine System

- When you face a danger, your body gets ready to fight a threat or to run away from it

1. Your eyes see danger and send a signal to the brain.
2. Your brain sends a signal to the body to initiate a reaction to the danger.
3. The endocrine system controls this reaction by stimulating glands to produce hormones to help the human body prepare to react.



Endocrine system: It is the system that consists of glands that produce hormones to make the body ready to react.



NOTE:

- The endocrine system keeps body temperature and blood pressure under control.

• عند التعرض لتهديد أو خطر ما، يستجيب جسمك بطريقتين إما بالاستعداد لمواجهة هذا التهديد أو بالهرب منه، وإليك كيفية الاستجابة:

1 ترى عيناك الخطر. 2 يرسل المخ إشارات إلى جسمك للاستعداد للاستجابة للخطر.

3 يتحكم جهاز الغدد الصماء في هذه الاستجابة عن طريق تحفيز الغدد لإفراز الهرمونات التي تساعد الجسم على الاستعداد للاستجابة.

• جهاز الغدد الصماء: هو الجهاز الذي يتكون من الغدد التي تفرز الهرمونات لتساعد الجسم على الاستعداد للاستجابة.

• ملحوظة: جهاز الغدد الصماء يتحكم في درجة حرارة الجسم وضغط الدم.

- When you feel stressed, other systems become involved as well, where:

1. Your muscles are tense.
2. Your heart rate and breathing speed up.





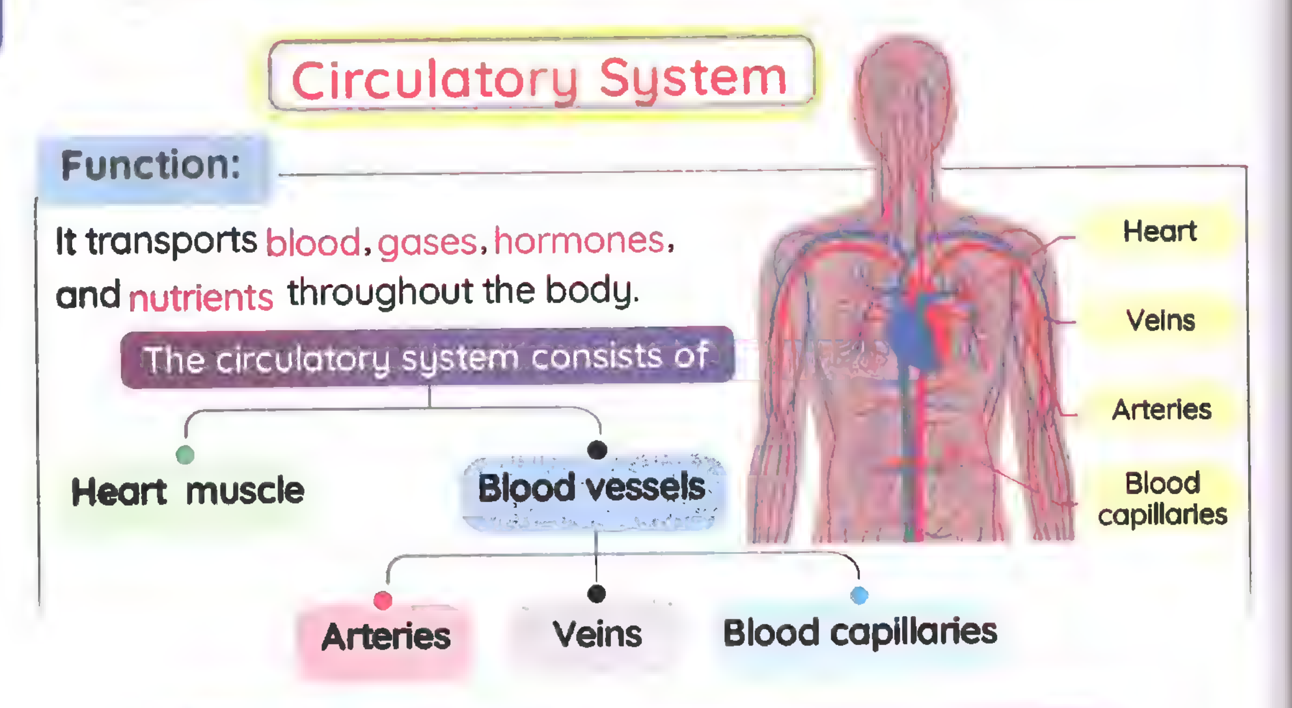


What Is a System?

During a fight-or-flight scenario, hormones released by the endocrine system need a way to travel around the body.

» Hormones travel around the body through the blood that moves inside blood vessels, which are part of the circulatory system.

Circulatory System



Function:

It transports blood, gases, hormones, and nutrients throughout the body.

The circulatory system consists of

- Heart muscle
- Blood vessels
  - Arteries
  - Veins
  - Blood capillaries

- Heart muscle pumps the blood throughout the body.
- Blood vessels allow blood to flow through the body.

» When the body is faced with danger, the heart rate increases as the heart begins to beat faster, so blood pressure increases because the heart pushes more blood to the muscles, heart, and other vital organs.

الجهاز الدوري:

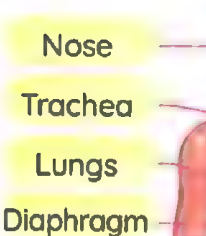
- **الأهمية:** ينقل الجهاز الدوري الدم، والغازات، والهرمونات، والعناصر الغذائية إلى كل أنحاء الجسم.
- **التركيب:** ـ عضلة القلب: تقوم بضخ الدم لجميع أجزاء الجسم.
  ـ الأوعية الدموية: تسمح بتدفق الدم عبر الجسم.

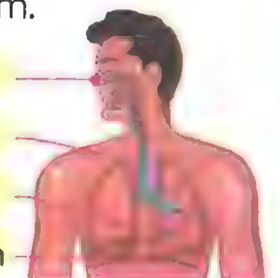
عندما يواجه الجسم خطرًا: يزيد معدل سرعة ضربات القلب، ويزداد ضغط الدم؛ لأن القلب يضخ الدم إلى العضلات والأعضاء الحيوية الأخرى.

Concept 2

Respiratory System

- The circulatory system depends on the lungs which are the main organ of respiratory system.
- The lung is an essential organ of the respiratory system.





Respiratory system

It is the system of organs and tissues that help you breathe.

- The respiratory system includes airways, lungs, and blood vessels.

Lungs	• Lungs take in oxygen gas and remove carbon dioxide gas as part of respiration and circulation processes.
Diaphragm	- The diaphragm is a muscle that helps with respiration, as follows: • When the diaphragm muscle contracts, the lungs take in air. • When the diaphragm muscle relaxes, air is pushed out of the lungs.
Bloodstream	• It transports oxygen from the lungs to all your organs and other tissues.

• يعتمد الجهاز الدوري في أداء وظيفته على الرئتين، اللتين تعدان جزءًا أساسيًا في الجهاز التنفسي.
• الجهاز التنفسي: هو شبكة من الأعضاء والأنسجة التي تساعد الشخص على التنفس؛ إذ يتكون الجهاز التنفسي من الممرات الهوائية، والرئتين، والأوعية الدموية.
- **الرئتان:** تمتص الرئتان الأكسجين وتطلقان ثاني أكسيد الكربون كجزء من عمليتي التنفس والدوران.
- **الحجاب الحاجز:** تساعد عضلة الحجاب الحاجز الإنسان على التنفس كما يلي:
عندما تنقبض عضلة الحجاب الحاجز تسحب الرئتان الهواء. عندما تنبسط عضلة الحجاب الحاجز، يخرج الهواء من الرئتين.
- **مجرى الدم:** يقوم بنقل الأكسجين من الرئتين إلى جميع أعضاء الجسم والأنسجة الأخرى.

- During the fight-or-flight response,
many body systems work together to help the body react to danger.

1 Endocrine System	• It releases hormones to initiate the fight-or-flight reaction.
2 Circulatory System	• The heart pumps blood quickly around the body. • Heart rate and blood pressure increase.
3 Respiratory System	• It begins working harder to send more oxygenated blood to the muscles and brain to increase stamina and reflexes.

Exercises on Lesson 3

1 Choose the correct answer:

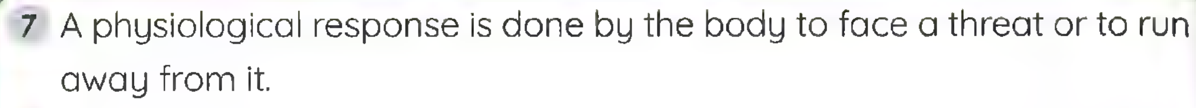
1. You can't control the movement of the .... muscle(s).
   a. neck b. stomach c. heart d. forearm
2. When you lift your head up, some muscles in your .... contract, and others relax.
   a. forearm b. eyelid c. heart d. neck
3. When two muscles work together to carry out a movement, one muscle ...., while the other ....
   a. moves, stays the same
   b. contracts, relaxes
   c. stays the same, relaxes
   d. stays the same, contracts
4. When your eyes see danger, it sends a signal to the ....
   a. heart b. brain c. stomach d. arm
5. The endocrine system controls your body's ....
   a. blood pressure
   b. releasing hormones
   c. temperature
   d. all the previous
6. When you feel stressed, all the following occur, except that ....
   a. your muscles become tense
   b. your heart rate slows down
   c. your heart rate speeds up
   d. breathing speeds up
7. All the following belong to the circulatory system, except ....
   a. arteries b. veins c. blood capillaries d. glands
8. The circulatory system carry all the following materials through the body, except ....
   a. hormones b. gases c. glands d. nutrients
9. The respiratory system uses which selection of organs to move gases in and out of the body? .
   a. Heart, veins, and arteries
   b. Nose, trachea, and lungs
   c. Muscles and bones
   d. Pancreas, gallbladder, and thyroid gland

2 Put (✓) or (✗):

1. You can control the movement of blood throughout your body. ( )
2. Muscles must contract and relax to allow body movement. ( )
3. Muscles that move your bones are skeletal muscles. ( )
4. The muscles around your eyeballs help you move your eyes in all directions. ( )
5. Diaphragm is an important organ in the respiratory system. ( )
6. When you turn your hand over, it takes the action of only one voluntary muscle in your forearm. ( )
7. When you twist your body to the left side, the two muscles on the right-side contract together. ( )
8. When you straighten your arm, the front muscles in the upper arm relax. ( )
9. There're two muscles that relax when your palm is facing down, and one muscle contracts. ( )
10. You can control the movement of your neck muscles. ( )
11. The endocrine system controls the fight-or-flight response. ( )
12. When you feel stressed, your heart rate and breathing also slow down. ( )
13. During a rapid breathing, more oxygenated blood is sent to the muscles and brain. ( )

3 Write the scientific term:

1. Muscles that you can control their movement.
2. Muscles that move your bones.
3. Muscles that move automatically without thinking of it.
4. The muscles that lie on each side of your body.
5. The system that activates the glands to release hormones in case of danger.
6. The pathways through which blood flows within the human body.



7 A physiological response is done by the body to face a threat or to run away from it.

8 The organs that are activated by the endocrine system release. hormones.

9 A system that transports blood, gases, hormones, and nutrients throughout the body.

10 Substances released by glands that stimulate body organs to face danger.

11 A muscle that has an important role in the respiration process.

4 Complete the following sentences using the words between the brackets:

(oxygen – relax - diaphragm – bloodstream - heart – contract - endocrine)

1 The .... pumps blood through your body to send .... to your cells.

2 When you bend your arm, the front muscles of your upper arm ...., and the back muscles ....

3 During a fight or flight response, hormones are released by the .... system in the ....

4 When the .... muscle contracts, the lung take in air.

5 Correct the underlined words:

1 **Voluntary** muscles are those that move without you consciously thinking about it.

2 You blink about **50** times a minute without even thinking about it.

3 When the heart beats faster, the blood pressure **decreases**.

4 Hormones are secreted by organs called **lungs**.

5 When the diaphragm muscle **contracts**, carbon dioxide is pushed out of the body.

6 Cross out the odd word:

1 Arteries – Heart – Blood capillaries – Veins

2 Forearm muscles – Heart muscle – Neck muscles – Abdomen muscles

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 The lung	a. releases hormones into the body
2 Abdomen muscles	b. is an organ of the respiratory system that take in oxygen gas.
3 Endocrine system	c. is a muscle that contracts to let oxygen gas enter the body.
4 Diaphragm	d. contract and relax while twisting your body.

1 .... 2 .... 3 .... 4 ....

8 Give reasons for:

1. The heart is an involuntary muscle.

   ....

2. The neck muscles are voluntary muscles.

   ....

3. The endocrine system plays an important role in a dangerous situation.

   ....

4. When facing danger, your blood pressure increases.

   ....

5. Various body systems work together under pressure.

   ....

9 What happens if:

1. The heart rate increases. (according to blood pressure)?

   ....

2. You close your eyelid?

   ....

3. The diaphragm muscle contracts?

   ....

4. The diaphragm muscle relaxes?

   ....





Activity 8 Getting Fuel

- Many body systems work together to keep your body working properly.
- These systems need fuel that comes from the foods we eat.



- These complex nutrients must be converted into simpler substances before they can be used to power the body cells.
- Inside the cells, some of these nutrients are used in the process of cellular respiration.

• تعمل العديد من أجهزة الجسم معًا لضمان أداء وظائف الجسم بشكل صحيح.
• تحتاج هذه الأجهزة إلى الطاقة لتعمل، وتتمثل هذه الطاقة في الغذاء الذي نأكله.
• يحتوي الغذاء على آلاف من العناصر الغذائية المختلفة، وتشمل هذه العناصر الغذائية العديد من الكربوهيدرات، والدهون، والبروتينات.
• يجب تحويل هذه العناصر الغذائية المعقدة إلى مواد أبسط قبل أن تستخدمها خلايا الجسم.
• بعض هذه المواد الغذائية يتم استخدامها داخل الخلايا في عملية التنفس الخلوي.

Function of the Digestive System:

It breaks down food into nutrients which the body can use for energy and growth.

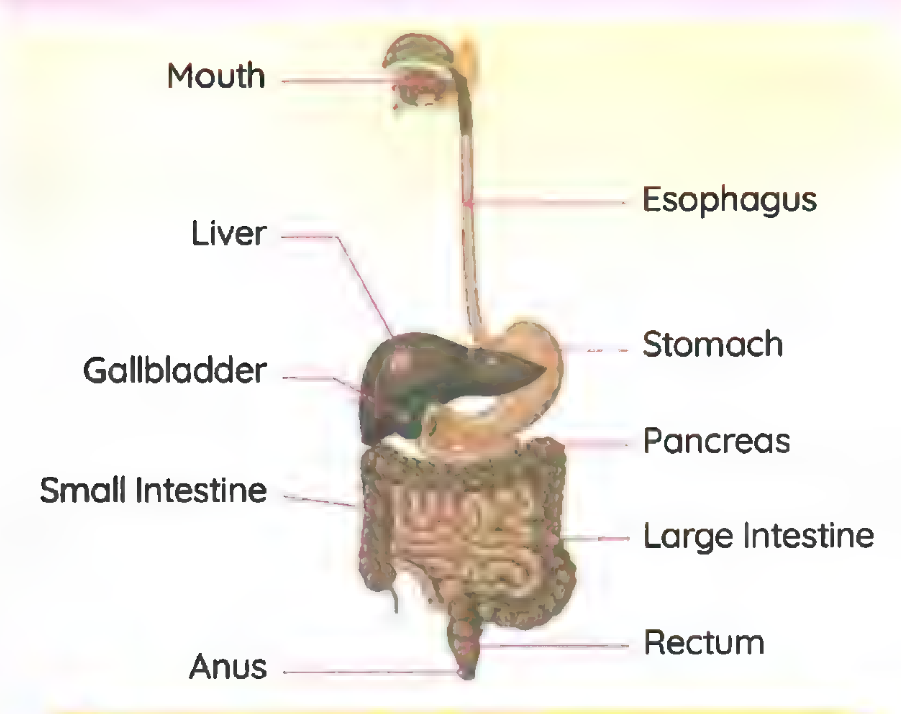
Digestion process: It's the process of conversion of food from a complex form into simpler substances (nutrients).



• أهمية الجهاز الهضمي: يقوم بتحويل الغذاء المعقد الذي نتناوله إلى مواد أبسط.
• الهضم: هو عملية تحويل الغذاء الذي نتناوله لمواد أبسط يستخدمها الجسم من أجل الحصول على الطاقة والنمو.

Concept 2

The Structure of the Digestive System



1 The Beginning of Digestion



(Inside the mouth)



» Digestion begins in the mouth with the first bite you have.

Jaw Muscles	• They create movement to help your teeth chew the food. • Chewing breaks up the food and increases its surface area. • This makes it easier for chemical enzymes (saliva) produced by the endocrine system to break down and digest food.
Saliva	• It softens the food by adding enzymes that get mixed with food to start the chemical breakdown.

» Then, muscles of the esophagus push the food down to the stomach.

• تبدأ عملية الهضم بمجرد دخول الطعام إلى الفم، وتتم عن طريق:

• عضلات الفك: – تتحرك لتساعد أسنانك على مضغ الطعام.

– تساعد عملية المضغ على تفتت الطعام وزيادة مساحة سطحه لتسهيل تفتيت وهضم الطعام بواسطة الإنزيمات الكيميائية التي يفرزها جهاز الغدد الصماء.

• اللعاب: – يضاف اللعاب إلى الطعام فيعمل على تليينه بواسطة الإنزيم الذي يحتوي عليه اللعاب، فتبدأ عملية التفكك الكيميائي.

• تدفع عضلات المريء الطعام إلى المعدة.

2 Breaking Down Food

a In the stomach:

- The continuous churning and the secreting of the stomach's digestive fluids (acid and enzymes) further break down the food.

• إن الحركة التموجية المستمرة للمعدة وإفراز السوائل الهاضمة من المعدة (الحمض والإنزيمات) يؤديان إلى المزيد من تفكيك الطعام.

b In the small intestine:

- The pancreas and gallbladder secrete additional enzymes that assist in the chemical breakdown of food.
- Absorption of nutrients takes place in the small intestine.

• تساعد الإنزيمات التي يفرزها البنكرياس والحويصلة الصفراوية على التفكك الكيميائي للطعام بمجرد انتقاله إلى الأمعاء الدقيقة.

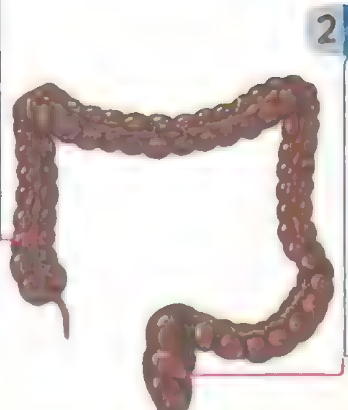
• يبدأ امتصاص العناصر الغذائية في الأمعاء الدقيقة.

Digested Food (Nutrients)	Undigested Food (Unused Materials)
They are carried away to the blood through the blood capillaries in the wall of the small intestine.	They are passed into the large intestine (colon), then exit the body as solid waste (stool).
	
• الطعام المهضوم: ينتقل من الجهاز الهضمي وصولًا إلى الدم عن طريق الشعيرات الدموية في جدار الأمعاء الدقيقة.	• الطعام غير المهضوم: يتم تمريره إلى الأمعاء الغليظة، والتي تعرف أيضًا باسم القولون، فتخرج هذه المواد التي لم يستفد منها الجسم على شكل براز.

- Digested food enters the blood stream as nutrients.
- Undigested (unabsorbed) food enters the large intestine as a soupy mixture.

1 Large intestine

- It reabsorbs most of the water, changing the liquid into solid waste called feces (stool).



2 Rectum

- It is the last section of the large intestine.
- Function:
  It stores feces until they're expelled.

3 Anus

- It is a muscular opening at the end of the rectum.
- Function:
  Waste materials are eliminated from the body through it.

- يدخل الطعام المهضوم إلى الدم في صورة عناصر غذائية.
- ينتقل الطعام غير المهضوم إلى الأمعاء الغليظة في صورة مزيج سائل.
- الأمعاء الغليظة:

تمتص معظم الماء من الطعام غير المهضوم لتكوين فضلات الطعام الصلبة التي يطلق عليها البراز.

- المستقيم:

– يطلق على الجزء الأخير من الأمعاء الغليظة المستقيم.

– يخزن المستقيم البراز قبل أن يتم إخراجه من الجسم.

- فتحة الشرج:

هي فتحة عضلية في نهاية المستقيم يتخلص الجسم خلالها من فضلات الطعام.

Unit 1

3 Transporting Nutrients

» Nutrients are transported to different organs via the circulatory system



Where do the nutrients go once they are in the blood



1. Some nutrients are used immediately
2. The rest of nutrients are stored

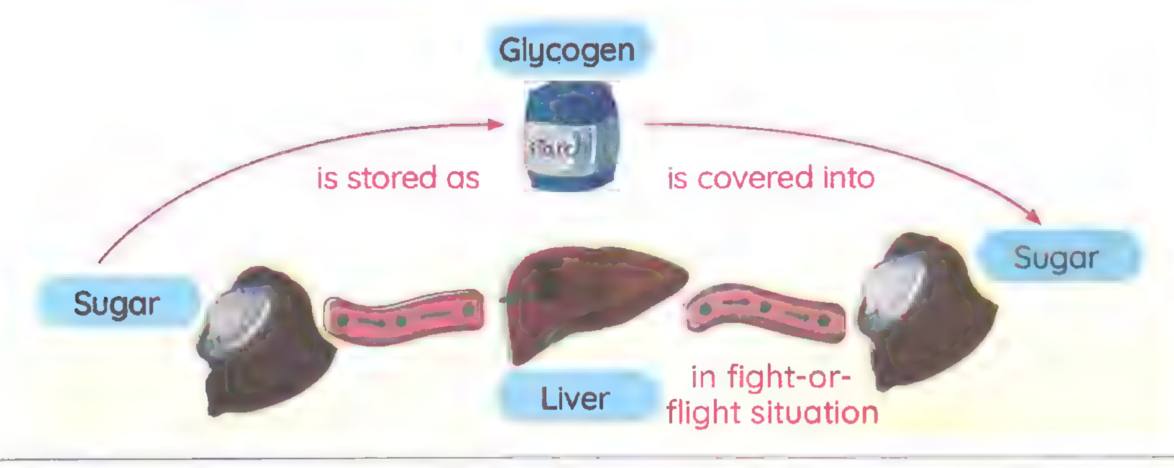
• For example:

a. Some nutrients are stored as fats.

b. The liver and muscles can store glucose sugar.

- They convert it into a special storage substance as an animal starch called glycogen
- The liver and muscles can then release the glucose when it is needed.

This stored energy comes in handy if you find yourself in a fight-or-flight situation.



• تنقل العناصر الغذائية إلى أعضاء مختلفة عبر الجهاز الدوري.

• أين تذهب العناصر الغذائية بمجرد وصولها إلى الدم؟

1 بعض هذه العناصر الغذائية يتم استخدامها على الفور.

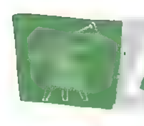
2 **الباقي يتم تخزينه فمثلًا:**

– بعض العناصر الغذائية الأخرى تختزن في صورة دهون.

– يمكن للكبد والعضلات تخزين الجلوكوز، وتحويله إلى مادة مخصصة لتخزين الطاقة في صورة نشا حيواني تسمى الجليكوجين.

– يمكن للكبد والعضلات بعد ذلك إطلاق الجلوكوز عند الحاجة.

• هذه الطاقة المختزنة يتم توظيفها عند تعرضك للخطر.



Activity  The Excretory System

- Not all the materials we consume daily (food, water and air) are useful.
- Also, many of the biological processes that occur in our body manufacture waste products.

Excretion It is the process of eliminating waste from the human body.

عملية الإخراج: هى عملية إخراج (طرد) الفضلات من خارج الجسم.

Excretory System

It collects waste materials produced by the cells, then remove them from the body.

What happens if...



- Your body did not remove waste.

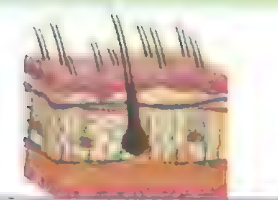
You would become sick.

• الجهاز الإخراجي: يجمع الفضلات الناتجة عن الخلايا ثم يقوم بطردها خارج الجسم.

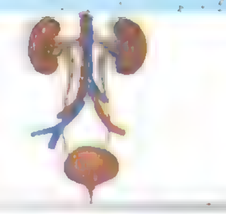
• إذا لم يتخلص جسمك من الفضلات فستصاب بالمرض.

The systems involved in excretion are

Skin	Respiratory System	Urinary System
When you sweat, waste leaves your body through the pores in your skin.	When you exhale, carbon dioxide gas leaves your body as waste.	It removes waste products from your blood.







What Is a System?




- Your digestive system is not involved in excretion.

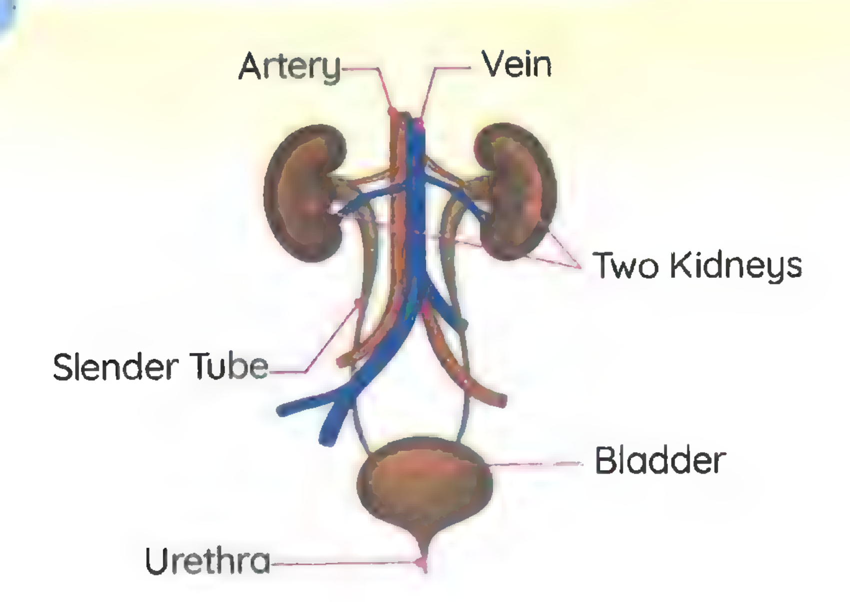
Because excretion means that waste materials must leave the body through a membrane.

• لا يشارك الجهاز الهضمي في عملية الإخراج؛ لأن مصطلح الإخراج يستخدم فقط عندما يلزم طرد الفضلات من الجسم عبر أحد أغشيته.

Urinary System

It is the system that removes harmful waste from your blood.

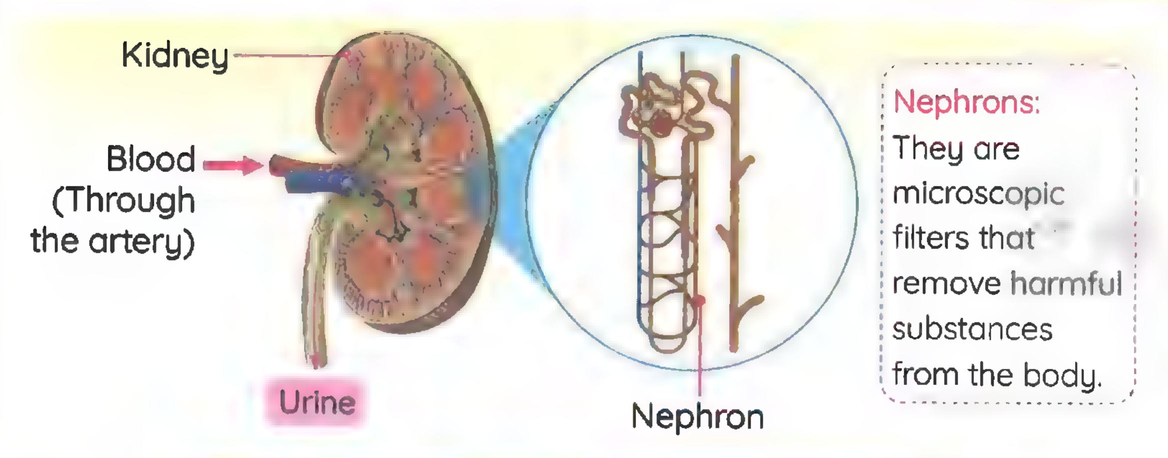
Structure



- Your kidneys play a very important role in the urinary system.
- Kidneys constantly clean and filter your blood, up to 300 times a day.

• تؤدي الكلى وظيفة مهمة جدًا في الجهاز البولي.

• الكلى هي المسئولة عن تنظيف وتنقية الدم باستمرار، بما يصل إلى 300 مرة في اليوم.



How the Urinary System Works

1. The large artery brings blood into each kidney.

2. Inside the kidney:
   - Tiny blood vessels branch off and pass through part of each nephron.
   - Nephrons filter the blood and remove harmful substances.

3. After filtering is complete, urea, other waste products, and water become urine.

4. Urine leaves each kidney through a slender tube and collects in the bladder.

5. The bladder empties through another tube called the urethra.

» Blood cells and proteins stay in the body. G.R

Because blood cells and proteins are too large to pass through the nephron.

- يوصل شريان كبير الدم إلى كل كلية.
- بداخل الكليتين:
  - تتفرع الشعيرات الدموية وتمر عبر النفرون.
  - النفرونات تعمل على ترشيح الدم وإزالة المواد الضارة من الجسم.
- بعد اكتمال عملية الترشيح، تصبح اليوريا، والفضلات الأخرى، والماء بولًا.
- ينتقل البول من كل كلية عبر أنبوب رفيع ويجتمع في المثانة.
- يتم تفريغ البول من المثانة عبر أنبوب يسمى القناة البولية.



- Urea is one of the most important waste products eliminated by the kidneys that come from the breakdown of proteins.
- تعد اليوريا إحدى أهم الفضلات التي تعمل الكلى على التخلص منها، والتي تتكون من تفكك البروتينات.

Urination It is the process of expelling urine from the body.

- Your body truly is an incredible food-processing machine.
- From the minute you take your first bite of food, your body gets busy changing the food you eat into the nutrients and energy you need to live and grow.





- جسمك يشبه آلة تُجري عملية معالجة للطعام بطريقة رائعة.
- من أول لحظة تتناول فيها أول قضمة من الطعام، ينشغل جسمك بمعالجة الطعام وتحويله إلى العناصر الغذائية اللازمة ليمد الجسم بالطاقة التي يحتاجها ليحيا وينمو.

Functions of the most important organs of the urinary system

Organ	Function
Kidney	It filters the blood from waste materials through the nephrons.
Slender Tube	It transfers urine from the two kidneys to the bladder.
Bladder	It stores urine till it is expelled outside the body through the urethra tube.
Urethra	It is a tube though which the urine leaves the body.

Exercises on Lesson 4

1 Choose the correct answer:

1. Digestion process starts in the ....
   a. stomach b. mouth c. esophagus d. large intestine
2. .... is secreted inside the mouth.
   a. Blood b. Acid c. Saliva d. Gallbladder
3. The food is broken down in the stomach by .... and ....
   a. saliva - acid b. enzymes - saliva
   c. hormones - enzymes d. acid - enzymes
4. All the following secrete enzymes to break down food, except ....
   a. stomach b. gallbladder c. large intestine d. pancreas
5. Unabsorbed food is stored in the ....
   a. colon b. gallbladder c. stomach d. small intestine
6. Liver and muscles can store .... in the form of ....
   a. fats - glucose b. glycogen - glucose
   c. glucose - glycogen d. glycogen - fats
7. In case of fight-or-flight, the liver converts .... into ....
   a. fats - glucose b. glycogen - glucose
   c. glucose - glycogen d. glycogen - fats
8. Nutrients are absorbed by blood capillaries in the wall of the ....
   a. stomach b. mouth c. large intestine d. small intestine
9. The water is reabsorbed from undigested food in the ....
   a. stomach b. small intestine
   c. large intestine d. pancreas
10. The primary job of the digestive system is to ....
    a. circulate blood around the body
    b. produce hormones
    c. break food into molecules that the body absorbs
    d. eliminate waste products
11. The body gets rid of carbon dioxide gas through the .... process.
    a. urination b. exhalation c. inhalation d. sweating

12 All the following are involved in the excretion process, except the ....

a. urinary system
b. skin
c. digestive system
d. respiratory system

13 The bladder expels urine through the .... outside the body.

a. slender tube
b. urethra
c. nephron
d. anus

14 Urine contains ....

a. water
b. urea
c. fats
d. a and b

15 Urine is collected in the .... to be emptied later.

a. bladder
b. gallbladder
c. large intestine
d. kidney

16 The .... belong(s) to the urinary system.

a. stomach
b. kidney
c. lungs
d. mouth

17 The .... are microscopic filters found in each kidney.

a. glands
b. bladders
c. nephrons
d. blood vessels

18 The .... system is responsible for eliminating carbon dioxide gas from the body.

a. urinary
b. digestive
c. respiratory
d. endocrine

19 Elimination of .... isn't considered an excretion.

a. sweat
b. urine
c. stool
d. carbon dioxide

2 Put (✓) or (✗):

1. Some nutrients are used inside the cell for respiration process. ( )
2. In digestion process, food is broken down from simple to complex molecules. ( )
3. Liver and muscles store glucose in the form of a plant starch called glycogen. ( )
4. The urinary system removes harmful waste from your blood. ( )
5. Nutrients are eliminated outside the cell, while waste materials are absorbed. ( )
6. The bladder and pancreas secrete enzymes on the food in the small intestine. ( )
7. Saliva breaks food chemically in the mouth. ( )

8 Stomach muscles churn the food to mix it with acid and enzymes. ( )

9 Unabsorbed food leaves the body in the form of solid waste. ( )

10 Some nutrients are used immediately and the rest are stored. ( )

11 The liver and muscles can't release the glucose when it is needed. ( )

12 Undigested food enters the large intestine as a soupy mixture. ( )

13 The digestive system starts with the mouth and ends with the anus. ( )

14 In excretion, waste materials pass through a membrane to leave the body. ( )

15 The excretory system removes the waste resulted from the composition of food in the cells. ( )

3 Write the scientific term:

1 It's the process of converting food into nutrients to power the body with energy.

2 It's a chemical substance that moistens food in the mouth.

3 It's the organ where the nutrients are absorbed.

4 It's the organ of the digestive system that stores unused food.

5 They're nutrients stored inside liver in the form of glycogen.

6 It is the solid mass into which the undigested food is converted.

7 It's the last section of the digestive system that ends with the anus.

8 It's the system that collects and gets rid of waste materials in the human body.

9 It's the most important organ of the urinary system that filters the blood from waste.

10 It's the organ that eliminates the waste in the form of sweat.

11 It is the process of expelling urine from the body.

12 It's a muscular sac that receives urine from the kidney.

13 They branch through the nephrons in each kidney.

14 It's a muscular opening at the end of the rectum.

4 Complete the following sentences using the words between the brackets:

A (filtering – Muscles – urine – Saliva – gallbladder – glycogen – Pancreas)

1. .... softens the food in the mouth, while the .... and .... pour their enzymes in the small intestine.
2. After .... the blood in the kidney, ... is formed.
3. .... and liver can store glucose in the form of an animal starch called ....

B (anus – artery – pores – jaw – rectum – nephrons – skin)

1. Muscles of the .... help the teeth in chewing food.
2. Feces are stored in the .... until they are expelled outside the body through the ....
3. When you sweat, waste leaves the body through the .... in your ....
4. Impure blood enters the kidney through a large ....
5. The kidney contains .... that filter blood from waste.

5 Correct the underlined words:

1. The urinary system belongs to the **digestive** system.
2. The **small intestine** muscles push food down to the stomach.
3. Chewing breaks up the food and **decreases** its surface area.
4. Nutrients are absorbed in the **large intestine**.
5. A large **vein** brings blood into each kidney.
6. Kidney constantly cleans and filters your blood, up to **100** times a day.
7. Urine leaves each kidney through a **urethra** tube.

6 Cross out the odd word:

1. Mouth – Stomach – Heart – Small intestine
2. Colon – Gallbladder – Rectum – Anus
3. Carbon dioxide – Sweat – Urine – Oxygen
4. Kidney – Bladder – Urethra – Skin

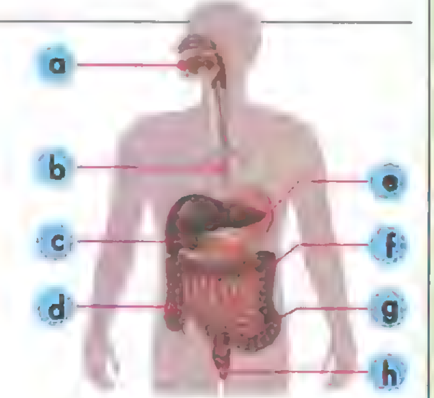


7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Glycogen	a. is solid waste that is stored in the rectum.
2 Stool	b. is stored in the bladder.
3 Nephron	c. is the stored form of glucose inside the liver.
4 Urine	d. filters the blood from waste materials.
5 Urea	e. is produced from breaking down the proteins.

1 .... 2 .... 3 .... 4 .... 5 ....

8 In the opposite figure:



1. The following figure represents ....
2. Write the following labels:

a .... b ....

c .... d ....

e .... f ....

g .... h ....

3. Mention the functions of part (f).

....

9 Give reasons for:

1. The food must be broken down inside the human body.
2. In case of fight-or-flight, the muscles convert glycogen into glucose.
3. Saliva has an important role in food digestion.
4. The excretory system keeps the body healthy.
5. The digestive system isn't involved in the excretion process.
6. Nephrons are considered microscopic filters.

10 What happens if:

1. Liver and muscles can't store sugar?
2. Saliva isn't secreted inside the mouth?
3. The human body is exposed to a dangerous situation (Concerning the stored glycogen)?
4. Water is absorbed from the undigested food?
5. Your body can't get rid of waste materials?
6. A human body suffers from a kidney failure?

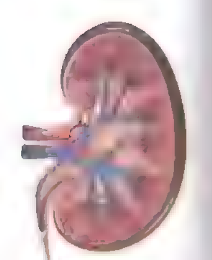
Lesson 5





Activity  Hands-on Investigation: Getting Rid of Waste

Experiment



In this activity, students develop a model of kidney that acts as a filtration system for the blood.

Tools:

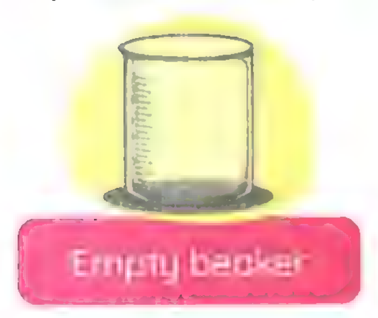


represents the nephron





represents proteins





Red beans

represent blood cells



represents blood



Salt

represents urea



Model has many details that replicate the real thing and do its function.

Steps:

1 2 3

4

Salty water (represents urine)

Red beans and rice

1. Add rice, salt and red beans to the cup of water and stir.
2. Put the filter in the funnel and place the funnel on the empty beaker.
3. Pour the mixture on the filter.
4. Observe which material can pass through the filter and which material can't pass through it.

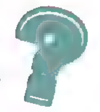
Observations:

- The small molecules, such as salt pass through the filter.
- The large molecules, such as red beans and rice can't pass through the filter.

Conclusions:

- The kidneys work as a filtration system for the blood as it removes waste products, such as salts which are excreted as urine.
- Red blood cells and proteins do not pass through the membrane inside the kidneys' nephrons.

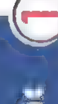
Give a reason for...



- We study a kidney model to stimulate the real one.

To save time, money and people's lives.

• لماذا نقوم بدراسة نموذج الكلية الذي يحاكي كلية حقيقية؟ للحفاظ على الوقت والجهد وحياة الأشخاص.



Unit 1

Activity  Systems Working Together

1 Tick (✓) in front of the statements that describe the excretory system.

1. The excretory system includes the stomach, pancreas, and intestines. ☐
2. The excretory system removes waste resulted from the composition of food in cells. ☐
3. The excretory system uses blood to carry oxygen from the lungs and food from the digestive organs to the body. ☐
4. The excretory system breaks down food so that it is available to provide energy and nutrients to the body. ☐

2 Write the name of each organ system next to the description of how it helps you get the energy you need.

Digestive System	Muscular System
Execratory System	Endocrine System

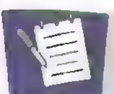
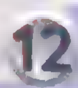
1. A person takes a bite of food and chews it into smaller pieces. Muscles in the jaw make it possible to chew. (..........................)
2. Enzymes are released and mix with the food to help break it down even further. (..........................)
3. The small intestine absorbs nutrients from the food, and undigested food moves into the rectum. (..........................)
4. Waste materials produced by the cells are collected and removed from the body, then filtered through the kidneys. (..........................)







Activity 12 Record Evidence Like a Scientist: Danger Response

» Now that you have learned about different systems in the human body, look again at Danger Response. You first saw this in Wonder.

Question:

» **How can you describe Danger Response now?**

My Claim:

....

....

....

Evidence:

....

....

....

Scientific Explanation:

....

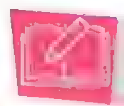
....

....

....

Unit 1

STEM in Action



Activity 13 Technology of Diabetes Treatments



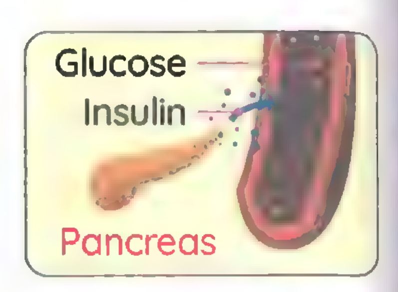
» We have learned that:

- The endocrine system produces hormones that regulate many processes in the body.

Pancreas:

It's an organ that produces the right amount of insulin to regulate the amount of sugar in your blood.

البنكرياس: هو العضو المسئول عن إفراز هرمون الإنسولين بالكميات اللازمة في الدم.



Hormone insulin:

It's a hormone that moves sugar from the blood into the cells.

هرمون الإنسولين: هو الهرمون الذى يقوم بنقل السكر من الدم إلى الخلايا.

Give a reason for...



- The pancreas must produce the right amount of insulin.

To regulate the amount of sugar in your blood.

What happens if...



- The pancreas is not working correctly in the human body?

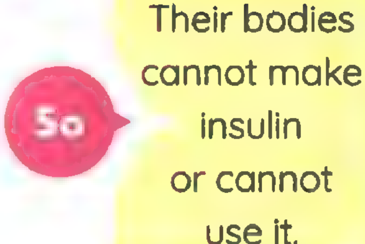
The person may suffer from diabetes.



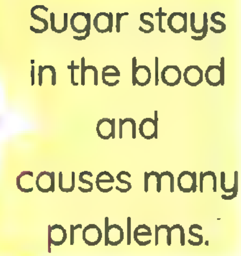
» Diabetes is one of the most well-known disorders of the endocrine system.

People with diabetes:

The pancreas is not working correctly. **So** →



Their bodies cannot make insulin or cannot use it. **So** →



Sugar stays in the blood and causes many problems.

• مرض السكر: هو أحد الاضطرابات الشائعة التي تصيب جهاز الغدد الصماء.
• مرضى السكر:
– يحدث قصور في أداء البنكرياس لوظيفته.
– لا تستطيع أجسامهم إفراز الإنسولين بكمية كافية أو استخدامه.
– يظل السكر في الدم مسببًا مشكلات كثيرة.

People with diabetes must carefully monitor how much sugar is in their blood. G.R



• Not to allow sugar to get too low or too high in the blood.

• يجب على هؤلاء الأشخاص مراقبة مستويات السكر في الدم، والحرص على عدم انخفاضها أو ارتفاعها بشكل كبير.

Treatment of diabetes:

Many people with diabetes must give themselves regular shots of insulin.

Insulin pump

Insulin pump: It's a device that is attached to the body to regulate blood sugar levels with automatic insulin injections.



• علاج مرضى السكر: يجب أن يحقن مرضى السكر أنفسهم بجرعات منتظمة من الإنسولين.
• مضخة الإنسولين: هي جهاز يتصل بالجسم، يساعد مرضى السكر على التحكم في مستوى السكر في الدم عن طريق حقن الإنسولين بشكل تلقائي.

Technology and diabetes:



Researchers are now working to develop an artificial pancreas as an internal organ instead of the external pump, so that it could deliver insulin as needed.

• التكنولوجيا ومرض السكر: يعمل الباحثون الآن على ابتكار بنكرياس صناعي كعضو داخلي بدلًا من توصيل مضخة إنسولين خارجية، وبالتالي يتم ضخ الإنسولين للجسم حسب الحاجة.

Exercises on Lessons 5 and 6

1 Choose the correct answer:

1. The .... works as a filtration system.
   a. heart   b. stomach   c. kidney   d. bladder
2. Salts are excreted from the body by the kidney as ....
   a. water   b. urine   c. blood   d. urea
3. .... and .... can't pass through the nephron's membrane.
   a. Salt - red blood cells   b. Protein - salt
   c. Salt - water   d. Protein - red blood cells
4. Diabetes is caused due to a disorder in the .... system.
   a. respiratory   b. digestive   c. urinary   d. endocrine
5. A diabetic person's body can't make or use ....
   a. salt   b. insulin   c. protein   d. muscles
6. Insulin is produced by the ....
   a. liver   b. stomach   c. gallbladder   d. pancreas
7. Researchers are now working to develop an artificial pancreas to treat .... disorder.
   a. diabetes   b. cancer   c. flu   d. thyroid

2 Put (✓) or (✗):

1. Red blood cells and protein are tiny molecules. (   )
2. Salt can pass through a paper filter. (   )
3. In the kidney's model, filter paper represents the membrane inside of a nephron. (   )
4. The blood is being filtered from waste by the heart. (   )
5. The digestive system removes the waste resulted from the composition of food in the cells. (   )
6. Nephron is the functional unit of kidneys. (   )
7. The excretory system uses blood to carry oxygen from the lungs to the body. (   )
8. Insulin is considered a hormone. (   )
9. The human body needs sugar to get energy. (   )
10. Endocrine system provokes the pancreas to produce insulin. (   )

3 Write the scientific term:

1. It's a type of cells that can't pass through the kidney's nephrons.
2. It's the process of removing waste from the blood by the two kidneys.
3. It's a replica that is simulating and function exactly like a real thing.
4. It's a disease in which the body can't make or use insulin.
5. It's a hormone that regulates the amount of sugar used by the body to get energy.
6. It's a device that is attached to the body that regulates blood sugar levels with automatic insulin injections.

4 Complete the following sentences using the words between the brackets:

(external – monitor – cells – diabetes – blood – insulin)

1. Insulin moves sugar from the .... to the .... to get energy.
2. The .... regulates the amount of sugar in the blood.
3. A diabetic person must carefully .... the level of sugar in their blood.
4. An artificial pancreas would allow people with .... to not need an .... insulin pump.

5 Choose from column (A) what suits it in column (B):

Column (A) Situation	Column (B) Responsible System
1 Jaw's muscles chew a bite of food into smaller pieces.	a. Endocrine system
2 Producing hormones that regulate many processes in the body.	b. Excretory system
3 Absorbing nutrients from food, and moving undigested food to the rectum.	c. Muscular system
4 Collecting and disposing of waste materials produced from the cells.	d. Digestive system

1 .... 2 .... 3 .... 4 ....

Unit 1

6 Give reasons for:

1. Red blood cells can't pass through the membrane inside the kidney's nephron.

....

2. Salt can pass through the nephron's membrane.

....

3. Kidneys are considered a filtration system for blood.

....

4. Some people may get diabetes.

....

7 What happens if:

1. A person's body can't make insulin?

....

2. People with diabetes don't obtain regular shots of insulin?

....

Model Exams On Concept 1.2

Model Exam 1

Question 1

(A) Choose the correct answer:

1. The .... pumps more blood to feed the body muscles to move.
   a. heart b. brain c. stomach d. lung
2. Bones, muscles, ligaments and tendons are form the components of the .... system.
   a. musculoskeletal b. digestive c. urinary d. respiratory
3. All the following are involved in the excretion process, except the ....
   a. urinary system b. skin
   c. digestive system d. respiratory system
4. The water is reabsorbed from undigested food in the ....
   a. stomach b. small intestine
   c. large intestine d. pancreas

(B) Give a reason for: Some people may get diabetes.

Question 2

(A) Put (✓) or (✗):

1. You can control the involuntary muscles. ( )
2. Neck muscles are from the abdominal muscles. ( )
3. Pancreas secrete digestive enzymes and insulin. ( )
4. Carbon dioxide gas is expelled outside the body through the skin. ( )

(B) Cross out the odd word: Kidney – Heart – Urethra - Bladder

Question 3

(A) Complete with the words between brackets:

(diaphragm - hormones - endocrine system - glycogen)

1. During a fight-or-flee response, ... are released by the .... in the blood.
2. When the .... muscle contracts, the lung takes in air.
3. The liver can store glucose in the form of ....

(B) What happens if: A person's kidney is damaged?

Model Exam 2

Question 1

(A) Choose the correct answer:

1. A diabetic person's body can't make or use ....
   a. salt b. insulin c. protein d. saliva
2. Muscles of the .... are voluntary muscles.
   a. stomach b. esophagus c. neck d. small intestine
3. All the following systems are involved in excretion process, except the ....
   a. skin b. digestive system
   c. respiratory system d. urinary system
4. .... are microscopic filters found in each kidney.
   a. Glands b. Bladders c. Nephrons d. Blood vessels

(B) Give a reason for:

– Saliva and jaw muscles have an important role in food digestion.

Question 2

(A) Put (✓) or (✗):

1. When your muscles contract, your body moves. ( )
2. The sympathetic nervous system stimulates the adrenal glands when feeling stressed. ( )
3. The heart muscle is from the involuntary muscles. ( )
4. The rectum is the last section of the small intestine where stool is stored. ( )

(B) Write the scientific term:

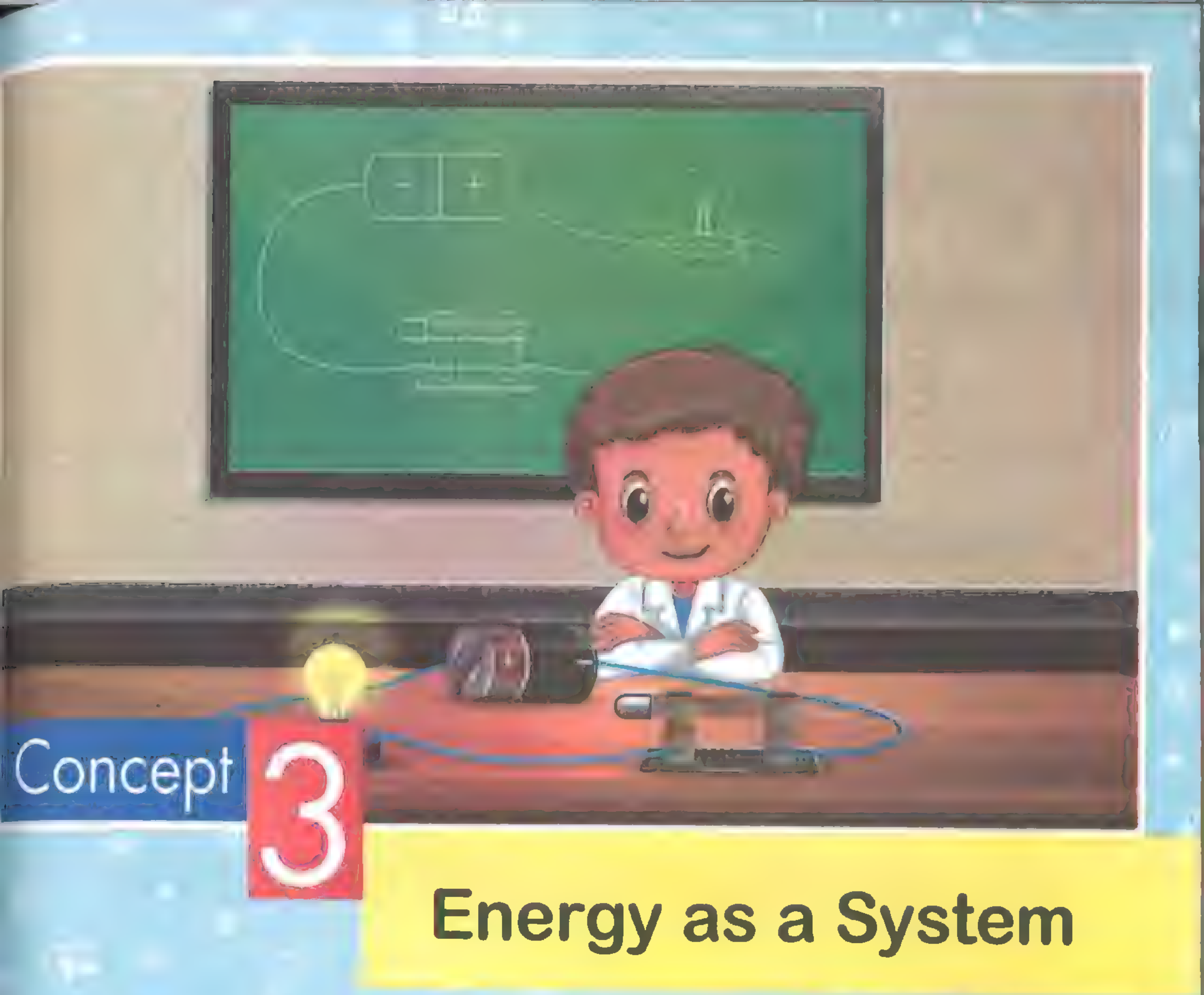
– It's a bundle of long fibers that can contract to allow movement.

Question 3

(A) Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. Digestive system	a. collects and removes the waste materials from the body.
2. Circulatory system	b. breaks food into molecules that the body absorbs.
3. Excretory system	c. helps the body to take in oxygen gas and expel carbon dioxide gas.
4. Respiratory system	d. transports oxygen and glucose to all the body cells.

(B) What happens if: Feeling stressed during a danger situation.



Concept 3

Energy as a System

Concept Objectives:

By the end of this concept, students will be able to:

- Develop a model to explain how magnetism, electricity, and force are related phenomena.
- Recognize an explanation that demonstrates understanding of the essential components of an electric circuit.
- Argue from the evidence that various factors affect the strength of electric and magnetic forces.
- Classify materials as conductors and insulators according to their ability to conduct electricity.
- Compare using evidence the results of connecting circuits in parallel and series circuits.

Key Vocabulary:

- Attract
- Repel
- Parallel circuit
- Series circuit
- Circuit
- Electrons
- Open circuit
- Closed circuit
- Resistor
- Generator
- Gravity
- Conductor
- Insulator
- Thermostat
- Switch
- Electric current
- Electricity
- Magnetism
- Magnet
- Turbine
- Conduct

Concept 3

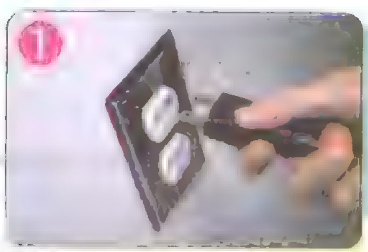
Energy as a System

Lesson 1	
Activity 1	Can You Explain?
Activity 2	Light Bulb Trouble
Activity 3	Magnetism and Gravity
Lesson 2	
Activity 4	Hands-on Investigation: Does It Attract?
Lesson 3	
Activity 5	Generating Electricity
Activity 6	What Do You Already Know About Energy as a System?
Activity 7	Components of a Circuit
Lesson 4	
Activity 8	Hands-on Investigation: Conductors and Insulators
Lesson 5	
Activity 9	Construct an Electric Circuit
Activity 10	Electric Circuits: Series Versus Parallel Circuits
Activity 11	Magnetism and Electricity
Lesson 6	
Activity 12	Circle Back: Energy as a System
Activity 13	How to Build a Pacemaker





Activity  1 Can You Explain?


▲ A wire connects a device to electricity.

1. Wires connect devices that are powered by electricity.


▲ Electrical poles inside walls


▲ Electrical poles outside

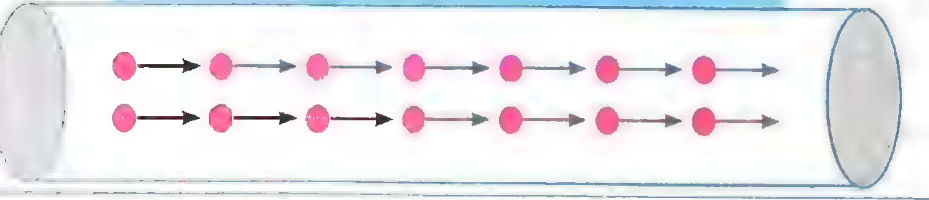
2. Electrical poles supporting wires outside and the wires inside walls are all examples of electric circuits.



3. Every time you flip a light switch or turn on an electrically powered device, you use electrical circuits.

Electricity : It is the flow of charged particles (electrons) through a wire.

The flow of electrons through a wire

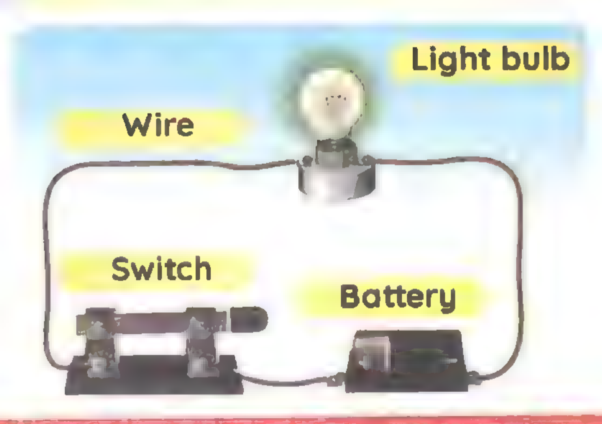


- تنتقل الطاقة الكهربية إلى الأجهزة التي تعمل بالكهرباء عبر الأسلاك.
- الأعمدة الكهربائية التي تدعم الأسلاك بالخارج والأسلاك داخل الجدران كلها أمثلة على الدوائر الكهربائية.
- في كل مرة تضغط على مفتاح الإضاءة أو تشغل جهازًا يعمل بالكهرباء، فإنك تستخدم الدوائر الكهربية.
- الكهرباء: هي تدفق الجسيمات المشحونة (الإلكترونات) عبر سلك.

Unit 1

Electric Circuit

Electric Circuit • It is a closed path that electricity flows through.



The Components of Electric Circuit

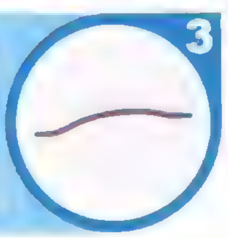
1 Battery
Is a source of energy in the circuit.



2 Switch
Is a device helps in opening and closing electrical circuits.



3 Wire
It connects the components of an electric circuit together.

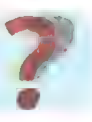


4 Light bulb
It shows the transfer of electricity.





How is the electrical circuit a system?



- A system is a group of things that work together for one purpose.
- The circuit works as one unit, like a system to make electricity flow.

كيف تعد الدائرة الكهربية نظامًا؟

• النظام هو مجموعة من الأشياء التي تعمل معًا لغرض محدد.
• تعمل الدائرة الكهربية كوحدة واحدة أو كنظام.

Check your understanding?



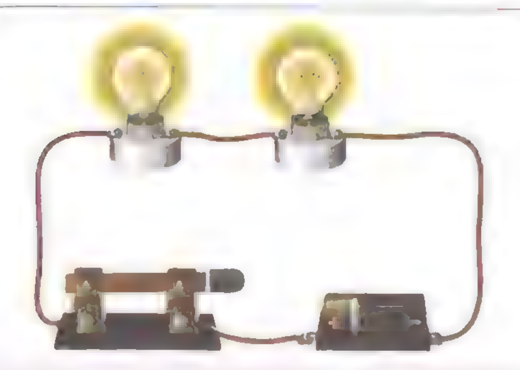
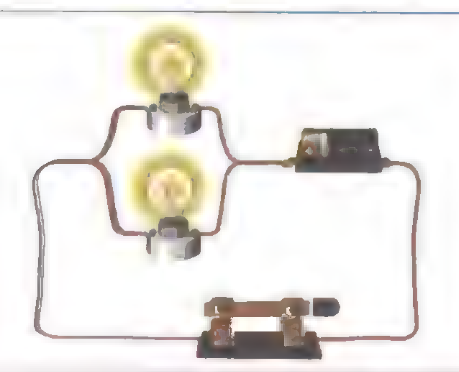
Put true or false:

1. A device operated by a battery is considered part of an electric circuit. ( )
2. Wires are used to connect the components of an electric circuit. ( )



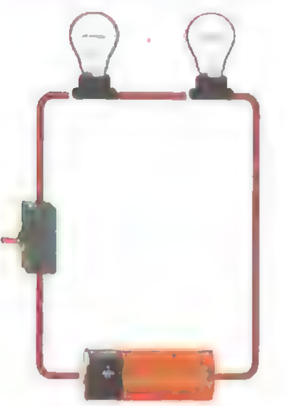
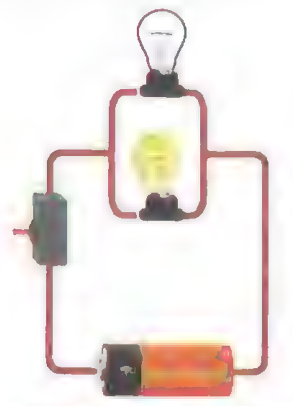
Activity 2 Light Bulb Trouble

» There are two ways of connecting for electric circuits.

Series Circuit	Parallel Circuit
A way of connection in which lights are connected in one path.	A way of connection in which lights are connected by multiple paths.
	
Electric current	
Current flows in a single (one) path.	Current flows in multiple paths.

What happens if...  One light is turned off



in a series circuit?	in a parallel circuit?
	
The other light will turn off because current flows in one path and the circuit becomes open.	The other light will still work because current flows in two paths and the circuit is still closed.

Unit 1

Check your understanding?

1 Compare the two figures of two different strings of lights when only one light has burned out, then choose the correct answer:

Figure (1) "All bulbs are turned off."	Figure (2) "Only one bulb is turned off."

1. Figure (1) represents a .... circuit. (series - parallel)
2. Figure (2) represents a .... circuit. (series - parallel)
3. All lights are turned off in Figure (1) because the circuit becomes .... (closed - open)
4. Some lights are still working in Figure (2) because the circuit is still .... (closed - open)

» In a series circuit, every device must function for the circuit to be complete.

» In parallel circuits, each device has its own circuit. The other device will still function, even if one is turned off.

- في الدائرة الموصلة على التوالي، تعمل كل الأجهزة معًا لتكتمل الدائرة.
- في الدائرة الموصلة على التوازي، تعمل لكل جهاز دائرته الخاصة وتظل باقي الأجهزة تعمل حتى لو تم إطفاء جهاز آخر.



Activity 3 Magnetism and Gravity

Choose the correct answer:

1. Both gravity and magnetism are ....
   a. invisible forces
   b. visible forces

2. Both gravity and magnetism are ....
   a. contact forces
   b. non-contact forces

Invisible force:

A force that we can't see, but we can see its effect.

Non-contact force:

A force that doesn't need objects to touch each other.

1 Gravitational Force

It is the force that attracts objects with mass downward to the Earth's center.

- Earth has great mass compared to every object located on its surface.
- All objects on or near Earth's surface are pulled downward toward its center.





- الجاذبية: هي القوة التي تجذب الأجسام التي لها كتلة لأسفل باتجاه مركز الأرض.
- الأرض: لها كتلة كبيرة مقارنةً بكل شيء موجود على سطحها؛ ولذلك فهي تحافظ على ثبات الأشياء والبشر على سطحها.
- تجذب الأرض كافة الكائنات الموجودة على سطحها أو بالقرب من سطحها باتجاه المركز.

Unit 1

What happens when... 



- You throw an apple up into the air?

It will stop moving upward and fall back to Earth due to gravity.

Factors Affect Gravity:



Mass

As the mass increases, the gravity increases.

Earth has | **Moon has**









Distance

As the distance etween objects and the center of the Earth increases, the gravitational force decreases and vice versa.



• عند رمي تفاحة في الهواء، ستتوقف عن الارتفاع في مرحلة ما، ثم تعود إلى الأرض بسبب قوة الجاذبية.

• **ثمة عاملان يؤثران في قوة الجاذبية؛ وهما:**

– **الكتلة:**

كلما زادت كتلة الجسم، زاد تأثير الجاذبية على الجسم.

– **المسافة:**

كلما زادت المسافة بين الأجسام، قل تأثير قوة الجاذبية.

2 Magnetism

The force that allows the magnet to attract or repel certain materials or other magnets towards it.



- Magnets are made of iron and other materials.
- All magnets have a north pole and a south pole.
- A magnet attracts magnetic material, but it doesn't affect non-magnetic material.
- A magnet attracts magnetic materials that only lie in its magnetic field.

Uses of Magnets:

Magnets are used in motors and computers.

- القوة المغناطيسية: هي القوة التي تسمح للمغناطيس بسحب أو جذب مواد معينة أو مغناطيسات أخرى تجاهه.
- تصنع المغناطيسات من الحديد أو من مواد أخرى.
- للمغناطيس قطبان: قطب شمالي، وقطب جنوبي.
- يجذب المغناطيس المواد المغناطيسية ولا يؤثر في المواد غير المغناطيسية.
- تؤثر المغناطيسية في أجسام معينة في مجالها المغناطيسي.
- استخدامات المغناطيس: يستخدم المغناطيس في المحركات وأجهزة الكمبيوتر.

Magnetism allows the magnet to:

1 Attract (pull)

- other magnets toward it.

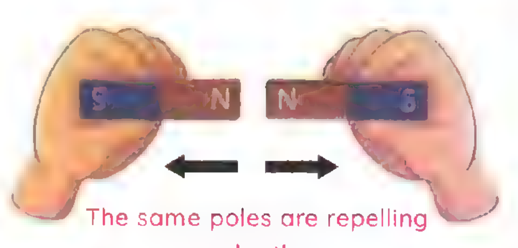
Different poles are attracted to each other.

- some materials.



2 Repel (push)

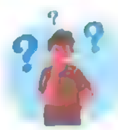
- other magnets away.



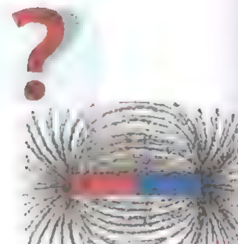
The same poles are repelling each other.

» Magnets produce a field around them called the magnetic field.

Magnetic Field • The space around the magnet in which the effect of magnetic force appears.



How can we see the magnetic field ?



» You can allow a magnet to interact with small iron filings.

» The pattern that the iron filings make near the magnet is the outline of the magnetic field.

• المجال المغناطيسي: هو المنطقة المحيطة بالمغناطيس والتي تظهر فيها قوة المغناطيس.

• كيف يمكننا رؤية المجال المغناطيسي؟

– عند السماح للمغناطيس بالتفاعل مع كمية صغيرة من بُرادة الحديد.

– فإن النمط الذي تشكله بُرادة الحديد بالقرب من المغناطيس، يُعرف بـ «مخطط المجال المغناطيسي».

P.O.C	Gravitational Force	Magnetism
Differences	• It attracts and never repels. • Gravity affects all objects that have mass on earth or near it.	• It attracts or repels. • It only attracts specific materials that lie in its magnetic field.
Similarities	• Both are invisible forces. G.R – Because we cannot see the magnetism field or gravitational force can only observe their effects. • Both are non-contact forces. G.R – Because they affect objects without direct contact.	



Check your understanding?

Put true or false:

1. Magnets pull or push on objects without touching them. (   )
2. Gravitational force can attracts and repels objects (   )

Exercises on Lesson 1

1 Choose the correct answer:

1. The electric circuit consists of all the following, except a ....
   a. battery   b. switch   c. wire   d. piece of paper
2. A/An .... is used to open and close the electric circuit.
   a. wire   b. switch   c. electric lamp   d. battery
3. A/An .... is a closed path through which electric current passes.
   a. magnetic field   b. battery   c. electric lamp   d. electric circuit
4. When a bulb from three bulbs in a circuit is burned out, the other two bulbs turn off, so that the bulbs must be connected in ....
   a. parallel   b. series
   c. square   d. non-consecutive
5. If one bulb from the following circuit is burned out, ...
   a. the other bulbs will turn off
   b. the other bulbs will stay on
   c. one bulb will turn off and the other will stay on
   d. the battery becomes stronger

   Switch
   Battery
6. A series circuit allows the current to flow in .... path(s).
   a. one   b. two   c. three   d. multiple
7. .... is/are the factor(s) affecting the gravitational force.
   a. Mass   b. Distance   c. Color   d. a and b
8. All objects on or near Earth's surface are .... toward the center.
   a. pulled down   b. pushed down   c. pulled up   d. pushed up
9. When sprinkling iron fillings on a magnet, we can see the ....
   a. mass of its magnetic field   b. shape of its poles
   c. pattern of its poles   d. pattern of its magnetic field

2 Put (✓) or (✗):

1. The battery is the source of electric current in the electric circuit. ( )
2. Electric current is the movement of charged particle within insulating material. ( )
3. Magnetism and gravity can attract some objects. ( )
4. Wires are used to connect the electric circuit components together. ( )
5. Magnets attract and never repel. ( )
6. Magnets attract all metals. ( )
7. We can see both gravity and magnetic forces. ( )
8. A person in a balloon in the air is affected by less gravitational force than that on Earth's surface. ( )
9. The magnet can attract an iron nail without being in contact with it. ( )
10. As the distance between an object and the earth increases, the gravitational force that affects this object increases. ( )
11. Magnets are made of iron only. ( )
12. We can see the effect of the magnetism. ( )
13. A magnet can attract a paper clip that is located outside its magnetic field. ( )

3 Write the scientific term:

1. It is a closed path through which the electric current flows.
2. A way of connection in which light bulbs are connected in multiple paths.
3. A way of connection in which light bulbs are connected in one path.
4. It is the force that attracts objects with mass downward to the Earth's center.
5. The space around the magnet is where its magnetic force appears.
6. The force that allows the magnet to attract or repel certain materials or other magnets towards itself.
7. A device is used to open and close the electric circuit.



Correct the underlined words:

1. There're **three** ways of connecting bulbs in an electric circuit.
2. **An insulating** wire allows the electric current to pass through.
3. The electric circuit works as one unit, like a system to make **magnetism flow**.
4. Both gravity and magnetism have in **contact** forces.
5. As the mass of an object increases, its gravitational force **decreases**.
6. The farther away objects are from Earth's surface, the **more** gravitational force they are affected by.
7. **The magnetic** force always attracts and never repels.
8. We can use **aluminium** fillings to see the magnetic field.
9. Earth has a **smaller** gravitational force than that on the moon.



Cross out the odd word:

1. Battery – Magnet – Wire – Light bulb
2. Gravity – Magnetism – Can repel or attract – Invisible force

Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 The magnetic field	a. is an invisible and non-contact force.
2 Iron	b. flows through a closed electric circuit.
3 Gravity	c. the force of a magnet appears in it.
4 Electricity	d. has a great mass compared to everything located on its surface.
5 Earth	e. is used in making magnets.

1 .... 2 .... 3 .... 4 .... 5 ....



7 Study the following figures, then answer the following questions:

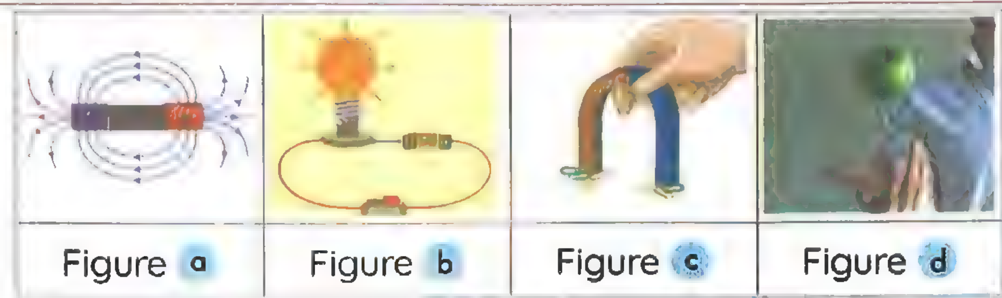


Figure a	Figure b	Figure c	Figure d

1. Figure (..........) represents an electric circuit.
2. Figure (..........) represents the gravitational force.
3. Figures (..........) and (..........) represent the magnetism.

8 Give reasons for:

1. The electric circuit is considered a system.
   ....
2. In a series connection, if one of the bulbs burns out, the other bulbs are turned off.
   ....
3. If you lift an object up in the air, it will return to the ground.
   ....
4. Both gravity and magnetism are invisible forces.
   ....
5. Both gravity and magnetism are non-contact forces.
   ....
6. Earth has a greater gravitational force than that on the moon.
   ....

9 What happens if:

1. One light is burned out in a series circuit. (according to other bulbs)?
   ....
2. One light is burned out in a parallel circuit. (according to other bulbs)?
   ....
3. You throw an apple up in the air?
   ....
4. You sprinkle iron filings on a magnet on a flat surface?
   ....







Activity 4 Hands-on Investigation: Does It Attract?



Experiment A Magnetic and Non-magnetic Materials

In this activity, you will test different materials to determine which objects are attracted to magnets.

Tools:

U-shaped magnet	Copper wires	Paper clips	Cardboard

Aluminium foils	Steel pins	Plastic fork	Iron nails

Steps:

1. Approach the magnet near each material.
2. Classify the materials into magnetic materials or not magnetic materials.

Observation:



- Not all metals are attracted to the magnet.
- Paper clips, steel pins, and iron nails are attracted to magnets.
- Copper wires, cardboard, aluminium foil, and plastic forks are not attracted to magnets.





Conclusion:

We can classify materials into two types:

P.O.C	Magnetic Materials	Non-magnetic Materials
Definition	• They are materials that attracted to magnets	• They are materials that cannot be attracted to magnets
Examples	Iron - Steel - Nickel	Copper - Aluminium - Plastic - Carton

Check your understanding?



Classify these materials into magnetic or non-magnetic:

Plastic bottle	Steel key	Wooden pencil
....	....	....

Eraser	Steel fork	Cloth
....	....	....



Experiment B Magnetic Force

» In this activity, you will compare the magnetic force of three different magnets with different sizes.

Tools:

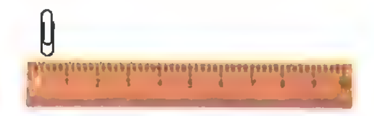
Small, medium, and large magnets	One paper clip	Ruler	Marker

NOTE

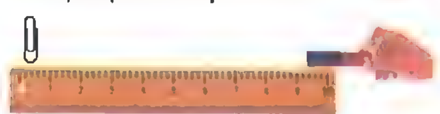
- You can use any small magnetic material instead of a paper clip.

Steps:

1. Place the paper clip at the 0 cm end of a ruler.



2. Bring the small magnet closer and closer to the paper clip.



3. Record the centimeter mark at which the paper clip is attracted.
4. Repeat steps 2 and 3 by using medium and large magnets.



Unit 1

Observation:

Size of Magnet	The distance at which the paper clip attracted
Small magnet	2 cm
Medium magnet	4 cm
Large magnet	8 cm

- The objects are attracted to the larger magnets from a farther distance.
- The objects are attracted to the smaller magnets from a shorter distance.

Conclusion:

- Larger magnets seem to be stronger than smaller magnets.
- The magnetic force depends on the size of the magnet.

Check your understanding?



Put true or false:

1. A large magnet can attract iron nails outside its magnetic field. ( )
2. A small magnet can attract an iron nail by touching it. ( )
3. Large magnets can attract all metals that exist in their magnetic field. ( )

Exercises on Lesson 2

1 Choose the correct answer:

1. All the following are magnetic materials, except ....
   a. paper clips b. steel pins c. iron nails d. cardboards
2. A/An .... is made of not magnetic materials.
   a. steel key b. plastic fork c. iron nail d. nickel medal
3. Which magnet is better at attracting objects from a farther distance?
   a. A small magnet b. A medium magnet
   c. A large magnet d. A weak magnet
4. The force of a magnet depends on the .... of it.
   a. shape b. temperature c. color d. volume
5. As an object goes further away from a magnet, the force of the magnet will ....
   a. decrease b. increase c. remains constant d. be doubled
6. If an iron nail isn't attracted to the magnet, this is because ....
   a. it may be a magnetic material
   b. the magnet is far from it
   c. it may be a non-magnetic material d. b and c
7. A small magnet can attract a paper clip at a distance of .... better than that at 5 cm.
   a. 3 cm b. 6 cm c. 10 cm d. 8 cm

2 Put (✓) or (✗):

1. Aluminum, iron, and steel are metals that are attracted to magnets. (   )
2. Paper clips are attracted to the magnet as they are a non-magnetic material. (   )
3. Large magnets can attract all metals that exist in their magnetic field. (   )

4. The magnet's shape affects the distribution of magnetic energy in its field. ( )
5. The force of a magnet depends on the size of the magnetic material. ( )

3 Write the scientific term:

1. They are materials that are attracted to a magnet.
2. They are materials that are not attracted to magnets.

4 Correct the underlined words:

1. Nickel is **non-magnetic** material.
2. Copper is a **magnetic** material.
3. A nail must get **further from** a small magnet to get attracted.
4. Large magnets seem to be **weaker** than small magnets.

5 Cross out the odd word:

1. Steel – Nickel – Copper – Iron
2. Aluminum – Steel - Glass – Wood

6 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Magnetic force	a. repel each other.
2 The same magnetic poles	b. is a non-magnetic material
3 Different magnetic poles	c. depends on the size of the magnet.
4 Copper	d. attract each other.

1 .... 2 .... 3 .... 4 ....

7 Classify the following objects as magnetic and not magnetic materials:

(Steel pin – Paper clip – Glass – Iron nail – Copper wire – Eraser – Cloth – Pencil)

Magnetic Materials	Not Magnetic Materials
....	....
....	....
....	....

8 Give reasons for:

1. The steel pins are magnetic materials.

   ....

2. The plastic fork isn't attracted to magnets.

   ....

3. It is easier for a large magnet to attract a paper clip than a small magnet.

   ....

9 What happens if:

1. You approach a magnet to a mixture of sand and iron filings?

   ....

2. You put a paper clip in the middle between two magnets of different sizes?

   ....





Activity 5 Generating Electricity

- Electricity can be generated in many different ways.
- Most of the world's electricity generation is carried out in electric power plants that use turbines to run generators.
- Turbines can run on renewable or nonrenewable resources.



Turbine:

It is a device used to run (spin) a generator.

Generator:

It's a device that changes kinetic (mechanical) energy into electrical energy.

Remember Energy cannot be created or destroyed.

Importance of the generator:

- A generator uses magnets and conductors to produce electricity to light homes and operate devices, such as computers and refrigerators.

- يمكن توليد الكهرباء بعدة طرق مختلفة.
- يتم توليد معظم إنتاج العالم من الكهرباء في محطات الطاقة الكهربية التي تستخدم التوربين لتشغيل المولدات.
- يمكن تشغيل التوربينات بالموارد المتجددة وغير المتجددة.
- التوربين: جهاز يستخدم لتشغيل المولدات الكهربية. • المولد: جهاز يقوم بتحويل الطاقة الميكانيكية إلى طاقة كهربية.
- أهمية المولد الكهربي:

يستخدم المولد الكهربي مغناطيسات ومواد موصلة لإنتاج الكهرباء لإضاءة المنازل وتشغيل الأجهزة مثل: أجهزة الكمبيوتر والثلاجات.

Different forces can be used to make the magnets spin at a high rate of speed.



- Wind-powered turbines can be used to spin magnets.



- Water from a dam flows across the turbine, causing the magnets to spin.



- Fuels, such as oil and coal, are used to make water boil.
- This creates steam, which causes a turbine to spin.

The spinning magnets create an electrical charge on the surrounding wires, and electricity is produced.

- يمكن استخدام توربينات الرياح ما يؤدي إلى دوران المغناطيسات.
- يتدفق الماء من السد عبر التوربين؛ مما يتسبب في دوران المغناطيسات.
- تستخدم مصادر الوقود كالنفط والفحم، لغليان الماء. ينتج عن هذا الغليان بخار؛ مما يؤدي إلى دوران التوربين.
- تولد المغناطيسات الدوارة شحنة كهربية على الأسلاك المحيطة، فيتم إنتاج الكهرباء.

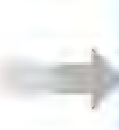



Activity 6 What Do You Already Know About Energy as a System?

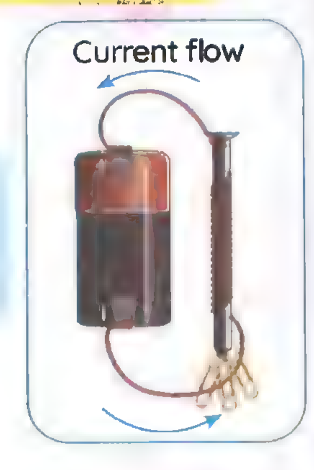
Electric current • It is the movement of charged particles through a conducting wire.

Magnetism and electricity can work together:

When an electric current flows through a wire,



a magnetic field is produced around the wire.



» If the wire is wrapped around a metal core, the magnetic field produced by the flowing current will become stronger.

التيار الكهربي: هو حركة الشحنات خلال سلك.

المغناطيسية والكهربية:

• عندما يتدفق تيار كهربي عبر سلك، ينتج عن ذلك مجال مغناطيسي حول السلك.

• إذا تم لف السلك حول قالب معدني، يصبح المجال المغناطيسي الناتج عن التيار الكهربي أقوى.

Magnetic Attraction

Which of the following materials does a magnet attract?

a. Nickel ☐ b. Plastic ☐

c. Gold ☐ d. Aluminum ☐

e. Iron ☐ f. Wood ☐



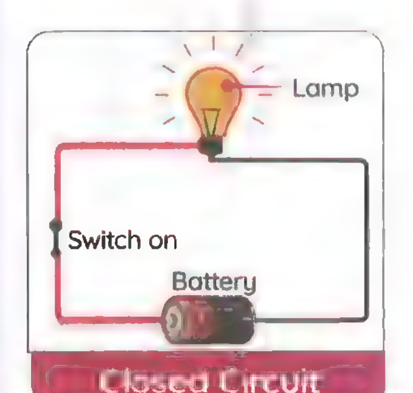


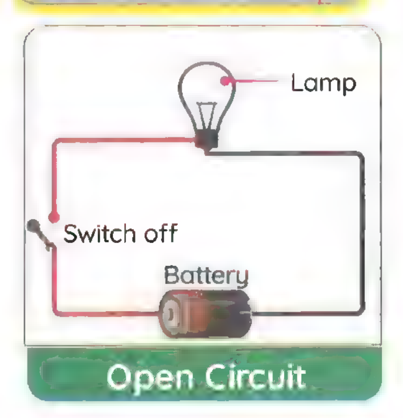
Activity  Components of a Circuit

Electricity:

- Electricity is a form of energy that comes from a flow of electric charges moving along a conductor.
- In order to do work, these charges, called electrons, must travel in a steady stream, known as an electric current.

Closed Loop





Electrons

They are tiny charged particles that flow in a closed circuit.

- For an electric current to flow through a circuit, the loop must be closed.
- This means it must begin and end in the same place, without any breaks in the path.

الكهرباء: • هي شكل من أشكال الطاقة التي تأتي من تدفق الشحنات الكهربية التي تتحرك في موصل.
• لبذل شغل، يجب أن تنتقل تلك الشحنات، التي تسمى الإلكترونات، في تيار ثابت يعرف بـ «التيار الكهربي».
مسار مغلق: • لكي يحدث تدفق للتيار الكهربي عبر الدائرة الكهربية، يجب أن يكون المسار مغلقًا.
• هذا يعني أن المسار يجب أن يبدأ وينتهي في نفس المكان، من دون أي فواصل في المسار.

Components of an Electric Circuit

 Source of electricity, as a battery or wall socket

 Solid metal wire

 Switch

 Electrically-powered device



- All parts of an electric circuit must conduct electricity.

Unit 1

The Switch

» It is the most common tool for people to open and close a circuit.

A switch can be:

1 Manual

Such as a wall switch for lights.



2 Automatic

Such as the internal switch on a thermostat.



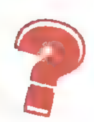
Thermostat: It's a device that adjusts the temperature inside appliances, such as refrigerators, by turning on or off.

المفتاح: هو الطريقة الأكثر شيوعًا لفتح وإغلاق الدائرة.

1 يمكن أن يكون المفتاح يدويًّا، مثل مفتاح الإضاءة على الجدار.

2 يمكن أن يكون المفتاح آليًّا، مثل: المفتاح الداخلي في الثرموستات، الذي يصدر الأمر بتشغيل الثلاجة أو إيقاف تشغيلها.

What happens if...



1 You turn the switch off in the electric circuit?

- The electric current doesn't flow through the circuit.

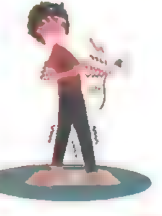
2 You turn the switch on in the electric circuit?

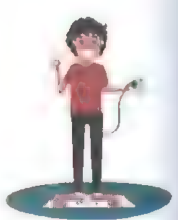
- The electric current flow through the circuit.

Current Safety

1 Touching an non-insulated wire will give you an electric shock and could even kill you. G.R

- Because our bodies contain a lot of water, and water is a good conductor of electricity.





2 Most electrical wires are coated with rubber or plastic. G.R



- To protect people from electric shocks because rubber and plastic are good insulators that resist the flow of electricity through them.

السلامة من التيار:

- سيؤدي لمس سلك يسري به تيار إلى صدمة كهربية وقد يسبب الوفاة؛ وذلك لأن أجسامنا تحتوي على الكثير من الماء، والماء موصل جيد للكهرباء.
- تكون معظم الأسلاك الكهربية مغلفة بالمطاط أو البلاستيك؛ لأن المطاط والبلاستيك من المواد العازلة التي لا تسمح بمرور الكهرباء خلالها.

Materials can be classified into two types

1 A conductor

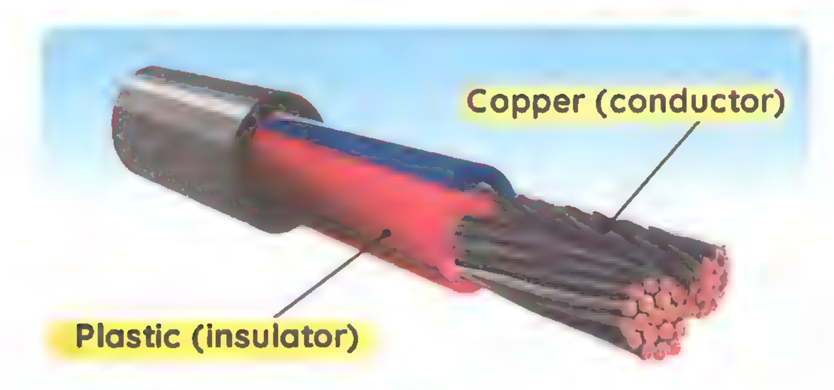
It's a material through which electricity flows easily.

Such as: copper and aluminum

2 An insulator

It's a material through which electricity does not flow easily.

Such as: rubber and plastic



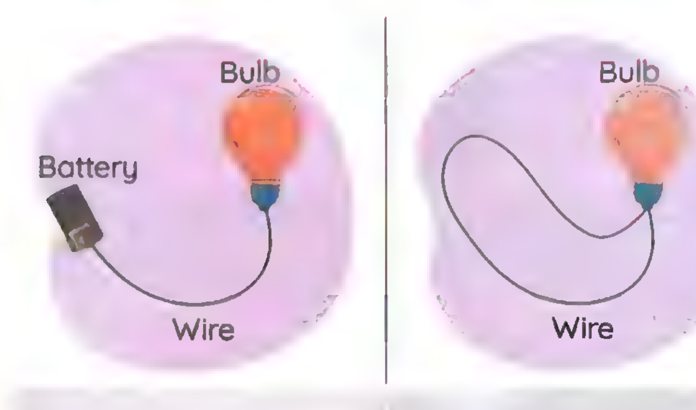
Check your understanding?

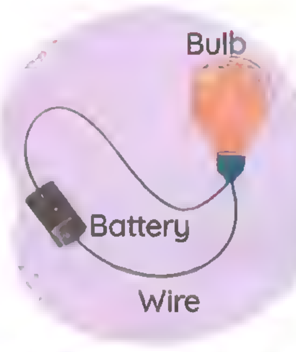


1 Put (✓) or (✗):

1. A circuit is a system made up of several parts. ( )
2. An insulator is a material that resists the flow of electricity. ( )

2 Examine the circuits in the diagram. Select the circuit that will cause the bulb to light up:





Circuit A	Circuit B	Circuit C







Activity  8 Hands-on Investigation: Conductors and Insulators

Experiment  **Conductors and Insulators**

» In this activity, you will investigate the conductivity of various materials.

Tools:

Battery	Wire (cord)	Small light bulb	Electrical tape
Aluminum foils	Eraser	Paperclips	Cloth
Wooden spoon	Coin		

Steps:

1. Use the wires, a bulb, and a battery to create a circuit.
2. Test each material in the circuit and record which materials conduct electricity or not.

Observations:

- Aluminum foils, paperclips and coins are conductors. G.R
  - Because electricity can flow easily through them.
- Rubber, cloth and wooden spoons are insulators. 
  - Because electricity cannot flow easily through them.

What happens if...



- You wrap one of the conductors in plastic?
  - The conductivity of the samples would be low because the electric current could not flow through the plastic.

Conclusion:

- We can classify materials into two types:

	Conductor	Insulator
Definition	It's a material through which electricity flows easily.	It's a material through which electricity does not flow easily.
Examples	Copper – Aluminum – Iron – Steel	Wood – Plastic – Cloth – Rubber

Check your understanding?



Put (✓) or (✗):

1. Insulators can protect us from electric shocks. ( )
2. Conductors are used to wrap cords. ( )

Exercises on Lessons 3 and 4

1 Choose the correct answer:

1. .... are used to run electric generators.
   a. Light bulbs b. Turbines c. Iron nails d. Batteries
2. .... change mechanical energy into electrical energy.
   a. Motors b. Electric bulbs
   c. Electric fans d. Generators
3. All the following are used to generate electricity in electric power stations, except ....
   a. huge magnets b. steam c. turbines d. batteries
4. The generator produces .... energy.
   a. mechanical b. chemical c. light d. electrical
5. The spinning of a/an .... creates electrical charges on the surrounding wires.
   a. magnet b. light bulb c. iron nail d. turbine
6. If a piece of .... is part of an electric circuit, no electric current passes through it.
   a. copper b. plastic c. iron d. steel
7. All the following are considered sources of electricity, except a ....
   a. battery b. wall socket c. switch d. generator
8. A .... makes the electric circuit closed by being a part of it.
   a. copper wire b. rubber band c. eraser d. plastic piece
9. .... allows electricity to pass through it.
   a. Rubber b. Wood c. Cloth d. Water
10. Wires are covered with plastic because it is considered a/an .... material.
    a. magnetic b. conducting c. insulating d. non-magnetic
11. The .... contains an internal automatic switch.
    a. wall socket b. battery c. thermostat d. magnet
12. All the following are electric conductors, except ....
    a. wood b. iron c. copper d. aluminum
13. .... resists the flow of electric current through it.
    a. Iron b. Silver c. Aluminum d. Rubber

14 .... is an electric conductor and also a magnetic conductor.
a. Copper b. Wood c. Iron d. Plastic

15 When an electric current flows through a wire, a/an .... field is generated around the wire.
a. electric b. gravitational c. magnetic d. thermal

16 The magnetic field produced when the electric current passes through a wire is .... that in a wire wrapped around a metal core.
a. weaker than b. equal to c. stronger than d. typical to

17 All the following materials are not attracted to magnets, except ....
a. plastic b. nickel c. wood d. rubber

18 A magnet will attract scissors if the scissors contain ....
a. iron b. copper c. plastic d. wood

19 To produce a magnetic field, you need all of these items, except a/an ....
a. wire b. iron bar c. aluminum bar d. battery

2 Put (✓) or (✗):

1. Energy can neither be created nor lost. ( )
2. Turbines can run only on renewable energy resources. ( )
3. Generators change electrical energy into mechanical energy. ( )
4. In a generator, many large magnets spin at a slow speed. ( )
5. When water boils, it turns into steam. ( )
6. Turbines can be run by wind or water flow. ( )
7. Water flowing from a dam can be used to move the turbines of a generator. ( )
8. Magnets, generators, and turbines can be used to generate electricity. ( )
9. The human body resists the flow of electricity. ( )
10. A wall socket brings in current from power lines connected to the building. ( )
11. Electricity is the flow of charged particles along an open path. ( )
12. A closed circuit means electricity must begin and end in the same place, without any breaks in the loop. ( )
13. An electric shock could kill a person. ( )
14. All materials are good conductors of electricity. ( )
15. An insulator resists the flow of electricity. ( )

Unit 1

3 Write the scientific term:

1. It is a form of energy that comes from the flow of particles moving along a wire.
2. They're tiny particles that flow along the electric circuit.
3. It is the closed loop for transmitting an electric current.
4. They're materials that allow electricity to flow through freely.
5. They're materials that don't conduct electricity.
6. It's the danger of electricity resulting from passing an electric current through the human body.
7. It's a device that has an automatic internal switch.
8. It's a device that converts mechanical energy into electrical energy.
9. It is used to move huge magnets in the generator.
10. They're types of energy resources used to boil water in an electric power station.
11. It's a facility that is used to generate electricity for homes, streets, and factories.
12. It's a type of energy that is produced from moving a magnet inside a conducting wire.

4 Complete the following sentences using the words between the brackets:

(metal core – electric charges – stronger – parallel circuit – steam – turbines – generators)

1. When water boils, it produces .... that causes .... to rotate.
2. In the generator, spinning turbines move the .... that create .... on the wire.
3. In a ...., each light has its own circuit.
4. If the wire is wrapped around a ...., the magnetic field generated by the electric current will become ....

5 Correct the underlined words:

1. Flowing water and wind are **nonrenewable** energy resources.
2. As the magnet moves faster inside a wire, the amount of electricity produced **decreases**.
3. All parts of the electric circuit must be electric **insulators**.
4. A furnace's thermostat is an internal **manual** switch.
5. The particles that travel along the electric circuit are called **protons**.
6. **All materials** are electric conductors.
7. **Conductors** can protect us from electric shocks.
8. **Turning on** a switch causes a gap in the circuit.

6 Cross out the odd word:

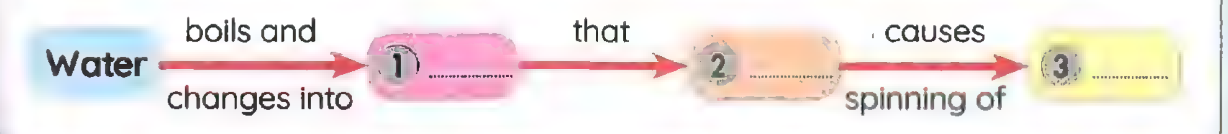
1. Wood chips – Coins – Plastic cubes – Cloth
2. Aluminum – Copper – Silverware – Rubber

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Switch	a. is used to make electric wires.
2 Copper	b. is the source of electric charges in the electric circuit.
3 Rubber	c. is used to open and close the electric circuit.
4 Battery	d. is used to cover electric wires.

1 .... 2 .... 3 .... 4 ....

8 Complete the following diagram that shows how the generator works:

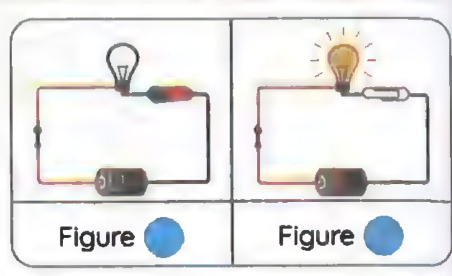


9 Classify the following objects into electric conductors and insulators:

(Copper - Plastic - Rubber - Silver necklace - Aluminum - Human body - Cloth - Wood - Iron)

Electric Conductors	Electric Insulators
....	....
....	....

10 Study the following figures, then answer the questions below:



1. Figure (.........) represents a closed electric circuit because ....
2. What happens if you remove the battery from figure (b)?

....

11 Give reasons for:

1. Electricity is very important in our daily lives.

....

2. The human body is considered an electric conductor.

....

3. The electric wires are covered with plastic.

....

4. Wood is considered an electric insulator.

....

12 What happens if:

1. The turbines of a generator stop spinning?
2. You turn the switch on in an electric circuit?
3. You touch a non-insulating electric wire that has an electric current?





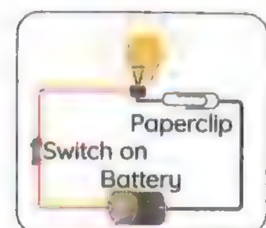
Activity 9 Construct an Electric Circuit

» You have learned that:

- Conductors are materials that allow electricity to flow through them easily.
- Insulators are materials that don't allow electricity to flow through them easily.

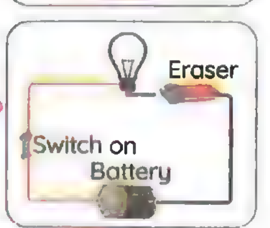
What happens if... ?

[1] A metallic paperclip is placed in a circuit with a battery and a bulb?



- Electricity will flow, and the bulb will light.

[2] An eraser is placed in a circuit with a battery and a bulb?



- Electricity will not flow, and the bulb will not light.

المواد الموصلة هي مواد تسمح للإلكترونات بالتدفق من خلالها بسهولة. • المواد العازلة هي مواد لا تسمح للإلكترونات بالتدفق من خلالها بسهولة.
[1] إذا تم وضع مشبك الورق المعدني، في دائرة كهربية بها بطارية ومصباح، فستتدفق الكهرباء، وسيضيء المصباح.
[2] إذا تم وضع المحاة، في دائرة كهربية بها بطارية ومصباح، فلن تتدفق الكهرباء، ولن يضيء المصباح.

Importance of Insulators

- They are used to coat wires, keeping us safe from getting shocked by the current when we are handling them.

Electric Resistors

They are components of a circuit that limit the flow of electrical current.

Importance:

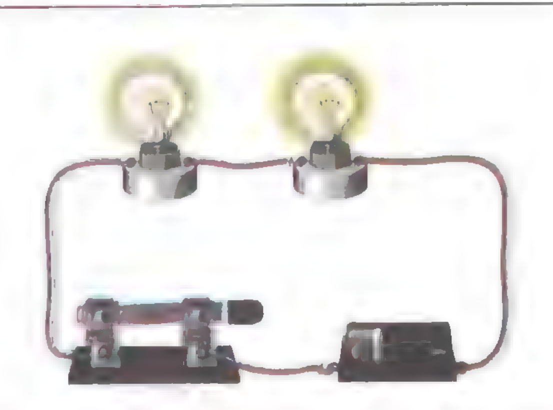
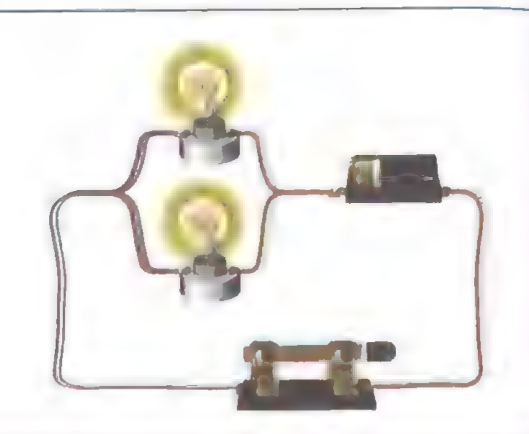
- Resistors are used to slow the flow of electrons through a circuit to limit the damage to the components of the circuit.
- In your kitchen, resistors can be found in toasters, microwaves and electric stoves.

أهمية المواد العازلة: تغطي المواد العازلة الأسلاك لتحافظ على سلامتك عند التعامل مع الكهرباء؛ ما يحميك من التعرض لصدمة التيار.
المقاومات الكهربية: هي أجزاء من الدائرة تحد من تدفق التيار الكهربي.
• يمكن استخدام المقاومات الكهربية لإبطاء تدفق الإلكترونات عبر الدائرة. يمكن اللجوء إلى ذلك للحد من الأضرار التي تلحق بمكونات الدائرة.
• يمكنك العثور على المقاومات الكهربية في مطبخك في محمصات الخبز، والميكروويف، والأفران الكهربائية.




Activity 10 Electric Circuits: Series Versus Parallel Circuits

» There are two ways in which a circuit can be connected.

Series Circuit	Parallel Circuit
It's a way of connection in which lights must be connected in a single path.	It's a way of connection in which lights are connected in different branches.
	
Components	
1 Energy source, such as a battery 2 Switch 3 Wire 4 Two lights connected in one route	1 Energy source, such as a battery 2 Switch 3 Wire 4 Two lights connected in two different routes
Electric Current	
Current flows in a single (one) path.	Current flows in multiple paths.
If one bulb is off or disconnected,	
The other light is turned off because the circuit is opened.	The other light remains as it is because the circuit is closed.

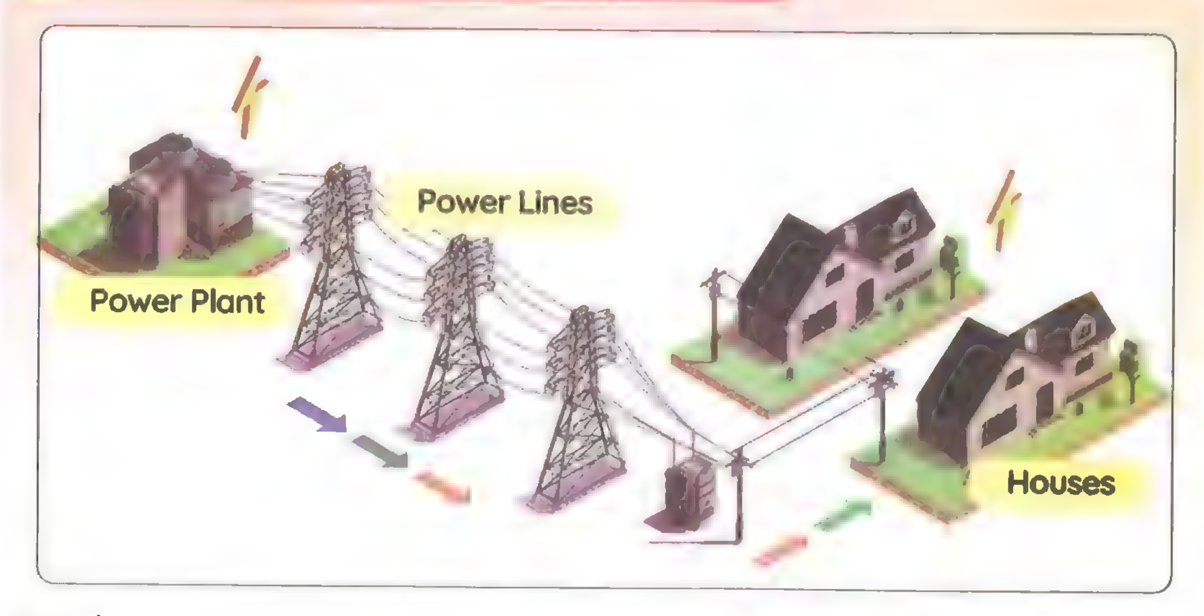
Electric circuit at houses:

- A parallel circuit is the type of circuit you would find in your house.
- You can operate a blender, toaster, and TV all at the same time, but if you turn one off, the others will continue to work just fine.



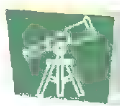
• الدائرة الموصلة على التوازي هي نوع الدائرة التي ستجدها في منزلك.
• يمكنك تشغيل الخلاط والمحمصة والتلفزيون جميعًا في الوقت نفسه، ولكن إذا قمت بإيقاف تشغيل أحدها، فسوف تستمر بقية الأجهزة في العمل بشكل جيد.

Electricity From Power Plants to Houses



- The energy source for entire towns and cities is the power plant, which has generators that push out electricity.
- Electricity travels along conductors called power lines into all kinds of electrical devices in homes, businesses, and factories.

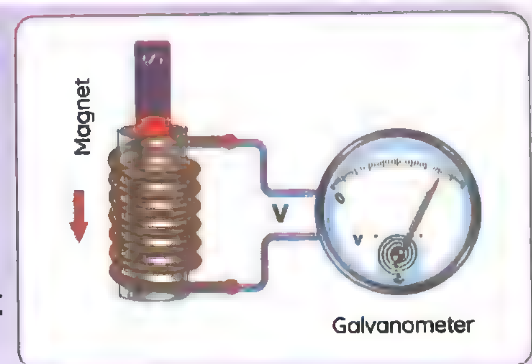
• مصدر الطاقة في المدن هي محطة توليد الكهرباء التي تحتوي على مولدات تدفع الكهرباء إلى الخارج.
• تنتقل الكهرباء عبر موصلات تسمى خطوط الطاقة، وتذهب إلى جميع أنواع الأجهزة الكهربية في المنازل، والشركات، والمصانع.



Activity  Magnetism and Electricity

Magnetism and electricity are related in several ways. One example of this relationship is electromagnetic induction.

Electromagnetic Induction:



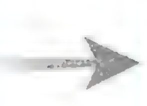
A scientist conducted an experiment, in which:

1. He tightly coiled a copper wire around a hollow cylinder.
2. He connected this coil to a galvanometer.

Galvanometer

It's a device used to indicate small electrical currents.

3. He then took a bar magnet and placed it at different proximities in relation to the coil.

When		Then
The magnet was at rest away from the coil,		the needle of the galvanometer did not move, indicating there was no current flow.
The magnet was moved towards and into the cylinder,		the needle moved to one side, indicating that there was current flow.

• أجرى أحد العلماء تجربة قام فيها بالآتي:

1 بلف سلك بإحكام حول أسطوانة مجوفة.

2 قام بتوصيل هذا السلك بجلفانومتر.

الجلفانومتر: هو جهاز يستخدم لقياس التيارات الكهربية الصغيرة.

3 ثم قام بوضع قضيب مغناطيسي على مسافات مختلفة من الملف.

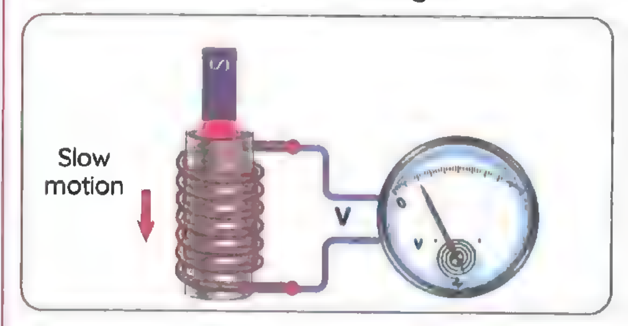
• عندما وضع المغناطيس ساكنًا وبعيدًا عن الملف، لم يتحرك مؤشر الجلفانومتر؛ مما يشير إلى عدم وجود تدفق للتيار.

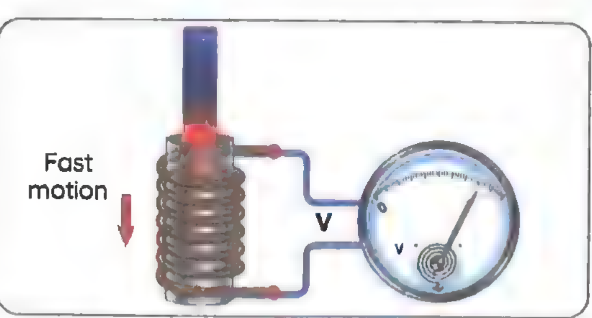
• بتحريك المغناطيس تجاه الأسطوانة وداخلها، تحرك مؤشر الجلفانومتر إلى أحد الجوانب؛ مما يشير إلى وجود تيار كهربي.

Factors Affecting the Induced Current

1 Speed of Magnet

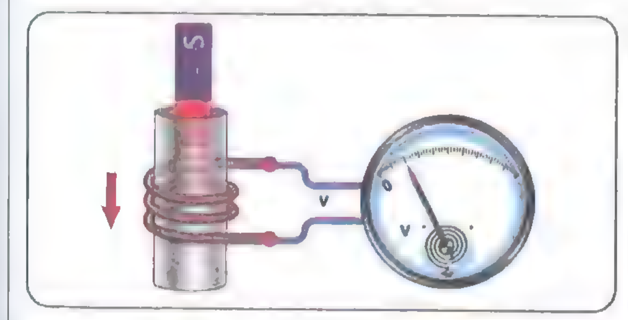
As the magnet moves faster, the needle moves faster, indicating an increase in the voltage.

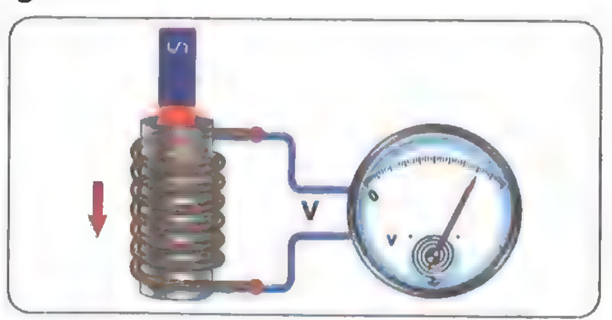




2 Number of Loops

As the number of coiled loops increases, the needle moves faster, indicating an increase in the voltage.





Where is electromagnetic induction used?

Electromagnetic induction is now used in electric motors, generators, and transformers.

Exercises on Lesson 5

1 Choose the correct answer:

1. If we want to limit the flow of the electric current in the circuit, we use ....
   a. batteries b. resistors c. switches d. ammeters
2. Inserting a/an .... into an electric circuit will allow electric current to pass.
   a. paperclip b. wood piece c. eraser d. plastic ruler
3. All the following devices have a resistor, except a/an ....
   a. toaster b. microwave c. electric stove d. gas stove
4. The power plants have .... to produce electricity.
   a. batteries b. power lines c. electromagnets d. generators
5. Resistors are used to .... the flow of electric current in the circuit.
   a. prevent b. decrease c. increase d. double
6. All the following can be used to light a bulb in a closed circuit, except a ....
   a. battery b. copper c. pencil d. paperclip
7. All devices in our houses are connected in ....
   a. a single path b. one branch c. parallel d. series
8. When we move a/an .... inside a copper coil, it will produce an electric current.
   a. iron nail b. magnet c. battery d. wire
9. Electromagnetic induction is now used in all the following, except ....
   a. electric motors b. generators c. natural magnets d. transformers
10. A moving magnet in a coil of wire induces a/an .... force.
    a. electromotive b. magnetic c. electric d. gravitational
11. A rapid movement of a galvanometer's needle indicates .... in the circuit.
    a. low voltage b. high voltage c. no voltage d. low heat

12 We can use the .... to indicate the passing of an electric current in a circuit.
a. galvanometer b. light bulb c. battery d. a and b

13 The induced current of a moving magnet inside a coil of 25 loops is less than that of ....
a. 20 loops b. 25 loops c. 40 loops d. 5 loops

14 The force of the induced current by a moving magnet in a coil depends on the ....
a. number of coil loops b. speed of the magnet
c. number of galvanometers d. a and b

2 Put (✓) or (✗):

1 It is safe to touch the electric wires coated with plastic. ( )

2 A paperclip is an insulator, while an eraser is a conductor. ( )

3 Resistors might be used to slow the flow of electrons through a circuit. ( )

4 Resistors are considered conductors. ( )

5 The parallel circuit doesn't have a switch. ( )

6 We can call the bulb in the circuit a load. ( )

7 You can't operate the TV and the toaster at the same time at home. ( )

8 Electricity can't be related to magnetism. ( )

9 In both series and parallel circuits, electric current returns to the power source. ( )

10 In a parallel circuit, if one device stops working, the other will still receive electricity. ( )

11 Power lines bring the electric current to the battery. ( )

12 An electric current can produce a magnetic field. ( )

13 Electrons must be static to produce a magnetic field. ( )

14 Electromagnetic induction represents a relationship between gravity and electricity. ( )

15 A galvanometer's needle will stop deflecting if a magnet stops moving in a coil. ( )

Unit 1

3 Write the scientific term:

1. They're materials that allow electrons to flow through them easily.
2. They're materials that don't allow electrons to through them easily.
3. They are parts of a circuit that limit the flow of electrical current.
4. It's a way of connection in which bulbs are connected in a single loop.
5. It's the type of circuit you would find in your house.
6. It's a type of devices that push out electricity in electric power plants.
7. They're conductors that transport electricity from power plants to appliances in homes.
8. It's a device used to detect a small electrical current in a circuit.
9. It is the process of generating an electric current using a magnetic field.
10. It's a part of the galvanometer that indicates the presence of voltage in the circuit.

4 Complete the following sentences using the words between the brackets:

(plugs - separately - closed - an insulator - electric current - a resistor)

1. Wires and .... of televisions are covered with plastic to prevent leakage of the ....
2. In an electric circuit, ... slows the flow of electric current, while .... stops it.
3. In a parallel circuit, components are connected to the power sources ...., so if one path is broken, the other remains ....

5 Correct the underlined words:

1. All electric circuits must be in <u>open</u> loops.
2. <u>A resistor</u> uses an electromagnetic force to measure the current in a circuit.
3. Resistors are used to <u>increase</u> the damage to the circuit components.
4. Appliances in our home are connected in a <u>series</u> circuit.
5. Conductors allow <u>light</u> to flow through.

6. If one component stops working in a **parallel** circuit, the circuit becomes open.
7. Electromagnetic induction shows a relationship between magnetism and gravity.
8. By increasing the speed of a moving magnet in a coil, the induced current decreases.

6 Mention one function of:

1. Insulators
2. Galvanometer

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Galvanometer's needle	a. can be produced by moving a magnet inside a coil of copper.
2 Electromagnets	b. have huge generators to push out electricity.
3 Induced current	c. produce a magnetic field by an electric current.
4 Power plants	d. doesn't deflect if there's no current in the circuit.

1 .... 2 .... 3 .... 4 ....

8 Study the following figures, then answer the questions below:

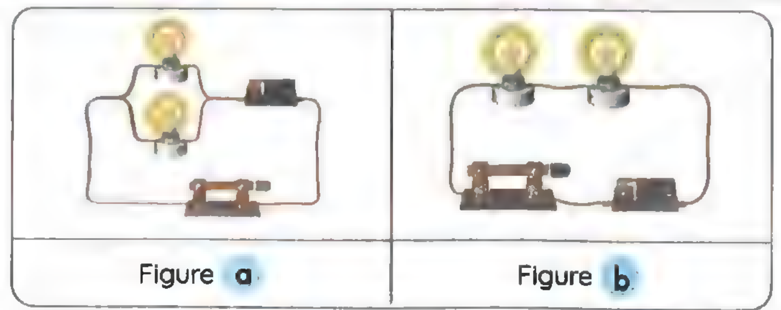


Figure a | Figure b

1. Bulbs are connected in multiple branches in figure (..........).
2. The way of connection in figure (..........) is used in your home.
3. If a bulb in figure (.......) is burnt out, the other bulb will turn off.

9 Study the following figure, then answer the questions below:

1. Number (1) represents: ....
2. Number (2) represents: ....
3. If we push and pull number (1) inside the hollow cylinder, ... force will be produced.

10 Give reasons for:

1. Insulators are used to coat wires.
   ....
2. Resistors might be used in an electric circuit.
   ....
3. It is preferable to connect electric appliances in a house in a parallel circuit.
   ....
4. A galvanometer needle deflects on moving a magnet inside a coil.
   ....
5. A galvanometer has a significant role in an electric circuit.
   ....

11 What happens if:

1. A wooden stick is placed in a circuit with a battery and a bulb?
   ....
2. A toaster has no resistors?
   ....
3. We use a conductor as a wire coat?
   ....
4. A television connected to a blender in a series circuit stops working?
   ....
5. You increase the speed of a magnet moving inside a coil connected to a galvanometer?
   ....
6. You decrease the number of the coil loops in which a magnet is moving?
   ....

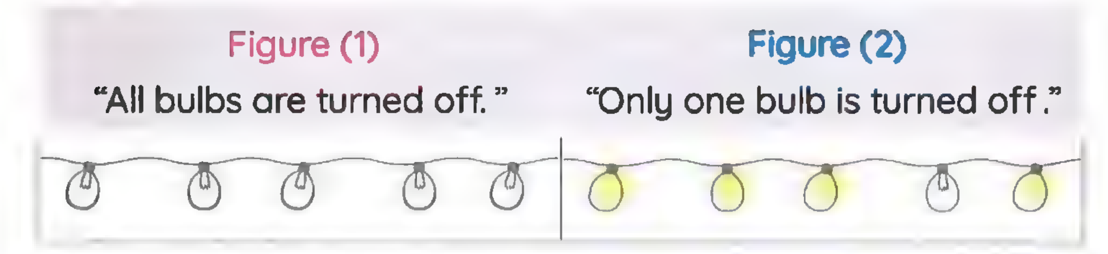






Activity 12 Record Evidence Like a Scientist: Circle Back: Energy as a System

» Now that you have learned about how energy is a system, look again at Light Bulb Trouble. You first saw this in Wonder.





Question:

» How can you describe Light Bulb Trouble now?

My Claim:



....

....

....

Evidence:

....

....

....

Scientific Explanation:

....

....

....



Activity 13 How to Build a Pacemaker





The Heart: Natural Pacemaker:

- The heart is an amazing muscle (organ).

Function (Job):

It beats consistently for the duration of our lives.



» The heart is a natural pacemaker. G.R



- Because a pacemaker creates electrical currents that it sends out through the heart, causing the heart to contract.

» Some people whose pacemaker starts to fail need an artificial pacemaker. G.R

- To keep the heart beating correctly.

• القلب: منظم ضربات طبيعي.
• يعتبر القلب عضلة وعضوًا مذهلًا.
• وظيفة القلب: عضلة تتمثل مهمتها في النبض باستمرار طوال فترة حياتنا.
– يعتبر القلب في الأساس منظم ضربات طبيعيًا، حيث يحتوي القلب على منظم، ينشئ هذا المنظم تيارات كهربية يرسلها عبر القلب؛ مما يتسبب في انقباض القلب.
– أحيانًا قد يحتاج الأشخاص الذين لديهم بطء في معدل ضربات القلب إلى منظم ضربات القلب الصناعي للحفاظ على ضربات القلب بشكل صحيح.

The Artificial Pacemaker:



- A battery-operated device that is inserted into the chest and stimulates the heart muscle to beat at regular intervals for patients who have a slow or irregular heartbeats.
- A pacemaker has been in use for over 60 years.

• منظم ضربات القلب: هو جهاز يعمل بالبطارية يتم إدخاله في الصدر ويحفز عضلة القلب على النبض على فترات منتظمة للمرضى الذين يعانون بطئًا في ضربات القلب أو عدم انتظامها.
• يستخدم منظمات ضربات القلب منذ أكثر من 60 عامًا.



The artificial pacemaker has a built-in antenna. 

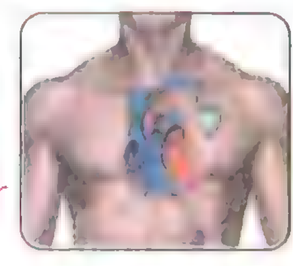
- To send information to physicians, so they know how the heat is behaving.

To build a pacemaker, you need:

1. A cell battery
2. An electrically conductive wire with a coating
3. A motherboard

The Future of Pacemakers:

- Pacemakers are getting better by the year.
- Pacemakers are becoming smaller too.
- Today, doctors can place a tiny, effective pacemaker well within the heart with a minimal procedure.



- منظم ضربات القلب الصناعي به هوائي (إيريال) مدمج لإرسال المعلومات إلى الأطباء ليتعرفوا على آلية عمل القلب.
- لصنع منظم ضربات القلب، تحتاج إلى:
  - بطارية.
  - سلك موصل كهربيًّا ومغلف بطبقة عازلة.
  - لوحة تحكم رئيسية.
- مستقبل منظمات ضربات القلب:
  - منظمات ضربات القلب تزداد تطورًا عامًا بعد عام.
  - يقل حجم منظمات ضربات القلب أيضًا.
  - يمكن للأطباء الآن وضع منظم ضربات القلب الصغير والفعال داخل القلب بأقل إجراء جراحي ممكن.

Exercises on Lesson 6

1 Choose the correct answer:

1. The artificial pacemaker is implanted inside the patient's ....
   a. stomach   b. brain   c. chest   d. arm
2. The artificial pacemaker is made up of all the following, except ....
   a. battery   b. motherboard   c. eraser   d. wire
3. The heart has its own built-in ....
   a. wire   b. pacemaker   c. battery   d. bomb
4. A pacemaker is very helpful for people suffering from ....
   a. diabetes   b. asthma
   c. heart problems   d. hearing problems

2 Put (✓) or (✗):

1. The artificial pacemaker replaces the function of the heart's electrical system. ( )
2. The artificial pacemaker is powered by a battery. ( )
3. The size of the used pacemaker now is smaller than that used in the past. ( )

3 Write the scientific term:

- It's a device used to help people with irregular or slow heartbeats.

4 Mention one function of:

- Pacemaker

5 Give reasons for:

1. The heart beats consistently for the duration of our lives.
2. A pacemaker is implanted in the chests of some patients.
3. The artificial pacemaker has a built-in antenna.

6 What happens if:

- The natural pacemaker of the heart starts to fail?

Model Exam 1

Question 1

(A) Choose the correct answer:

1. The electric circuit is composed of all the following, except a ....
   a. battery b. switch c. wire d. piece of paper
2. A small magnet can attract a paperclip at a distance of .... better than that at 5 cm.
   a. 3 cm b. 6 cm c. 10 cm d. 8 cm
3. All the following are used to generate electricity in electric power stations, except ....
   a. huge magnets b. conducting wires c. turbines d. batteries
4. A moving magnet in a coil of wire induces a/an .... force.
   a. electromotive b. magnetic c. electric d. gravitational

(B) Give a reason for: Insulators are used to coat wires.

Question 2

(A) Put (✓) or (✗):

1. The human body is considered a bad conductor of electricity. ( )
2. Metallic paperclips are attracted to the magnet as they are non-magnetic materials. ( )
3. A battery is the source of electric current in the electric circuit. ( )
4. The size of the used pacemaker now is smaller than that used in the past. ( )

(B) Cross out the odd word: Aluminum – Copper – Iron – Rubber

Question 3

(A) Complete with the words between brackets:

(Resistors – electrons – galvanometer - charged particles)

1. A .... is used to indicate the small current in a circuit.
2. .... are used in the electric circuit to limit the flow of electricity.
3. Electric current is a flow of .... called ....

(B) What happens if: You turn on the switch in the electric circuit?

Model Exam 2

Question 1

(A) Choose the correct answer:

1. .... is/are the factors affecting the gravitational force.
   a. Mass b. Distance c. Color d. a and b
2. All the following are magnetic materials, except a/an ....
   a. steel key b. plastic fork c. iron nail d. nickel medal
3. The generator produces .... energy.
   a. mechanical b. chemical c. light d. electrical
4. A rapid movement of a galvanometer's needle indicates .... in the circuit.
   a. low voltage b. high voltage c. no voltage d. low heat

(B) Give a reason for:

- The heart beats consistently for the duration of our lives.

Question 2

(A) Put (✓) or (✗):

1. Electricity can't be related to magnetism. ( )
2. Magnets pull or push on objects without touching them. ( )
3. A circuit is a system made up of several parts. ( )
4. Water flowing on a dam can be used to spin a generator. ( )

(B) Write the scientific term:

- It's a closed path through which the electric current passes.

Question 3

(A) Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. Galvanometer's needle	a. stimulates the heart muscle to contract at regular intervals.
2. Pacemaker	b. is an invisible and non-contact force.
3. Copper	c. doesn't deflect if there's no current in the circuit.
4. Gravity	d. is used to make electric wires.

(B) What happens if:

- You approach a magnet to a mixture of sand and iron filings?

School Book Assessment on Unit 1

1 Choose the correct answer:

1. Which of the following is a list of components of a body system in order from the least complex to the most complex?
   a. Tissue, cell, organ, body system b. Cell, tissue, organ, body system
   c. Body system, organ, cell, tissue d. Organ, tissue, cell, body system
2. Nutrients and oxygen enter the cells through the ....
   a. cell membrane b. mitochondria c. ribosomes d. nucleus
3. Which of the following structures is found in both plant and animal cells?
   a. Cell membrane b. Cell wall
   c. Large, water-filled vacuole d. Chloroplasts
4. .... is (are) the control center of the cell and is (are) responsible for cell division.
   a. Mitochondria b. Nucleus c. Golgi apparatus d. Chloroplasts
5. Which of the following is found in an acacia plant leaf and is not found in human?
   a. Cell wall b. Mitochondria c. Cell membrane d. Cytoplasm
6. When two muscles work together to carry out a movement, one muscle .... while the other ....
   a. moves, stays still b. contracts, relaxes
   c. stays still, relaxes d. stays still, contracts
7. Which of the following muscles is voluntary?
   a. Stomach muscles b. Small intestine muscles
   c. Esophagus muscles d. Neck muscles
8. Which selection of organs does the human body use to move gases in and out of the body?
   a. Heart, veins, and arteries b. Nose, trachea, and lungs
   c. Muscles and bones
   d. Pancreas, gallbladder, and thyroid glands
9. Which systems are involved in the process of excretion?
   a. Respiratory, circulatory, and digestive
   b. Urinary, skin, and respiratory c. Circulatory, skin, and nervous
   d. Nervous, respiratory, and digestive

10 What are nephrons?

a. They're vessels for that hold urine before it leaves the body.
b. They're the place where urine leaves the body.
c. They're organs that break food into smaller parts.
d. They're microscopic filters that remove harmful substances from the blood.

11 Diabetes is a disorder of the endocrine system. In people with diabetes, the .... does not produce enough insulin.

a. gallbladder b. thyroid gland c. pancreas d. small intestine

12 The factors on which gravitational force depends are ....

a. mass and shape b. size and shape
c. mass and volume d. distance and mass

13 .... is one of the electrical insulating materials.

a. Rubber b. Iron c. Copper d. Aluminum

14 When a piece of wood is replaced by a piece of aluminum in an electrical circuit, this causes ....

a. current flow b. the circuit to open
c. the circuit to close d. the lamp to light

15 From the conditions for lighting a lamp in an electrical circuit is ....

a. the presence of a battery in the circuit
b. the key is on
c. there is no insulating material in the circuit path
d. all the above

2 Complete using the following word bank:

(cell membrane – organelles – organs – cell wall – circulatory system – digestive system – kidneys – bladder)

1 The .... surrounds the cell membrane.

2 The small structures inside the cell are called ....

3 The system in the human body consists of a group of ....

4 The .... allows water to enter and exit the cell to maintain water balance on both sides.

5 The heart beats in the .... system accelerates when feeling afraid.

6 The .... in the urinary system purify the blood.

3 Write the scientific term:

1. It's a group of organs that work together to perform a specific function.
2. It's a device used to examine very small things.
3. It's the pattern formed by iron filings near the magnet.
4. It's a system that secretes hormones stimulating the rest of the body's systems to respond.
5. They're small electric charges moving in the wires in a closed electrical circuit.

4 Put (✓) or (✗):

1. All cells are formed of organelles, each of which performs a different function. ( )
2. A tissue consists of a group of similar cells. ( )
3. Water and waste are stored in the vacuole. ( )
4. Plant and animal cells are completely similar in structure. ( )
5. All living cells contain chloroplasts. ( )
6. The brain does not respond when feeling stressed. ( )
7. Every system in the body works individually when exposed to danger. ( )
8. Sweat is excreted by the lungs.
9. The skin takes part in expelling sweat through the pores. ( )
10. The muscles of the body work together at the same time. ( )
11. A human can control the movement of blood in his body. ( )
12. Muscle cells are short fibers that allow movement, storage and release of energy. ( )

5 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Excretory system	a. releases hormones into the body.
2 Endocrine system	b. cleans the blood and excretes the body waste.
3 Musculoskeletal	c. tissues contract and allow for body movement.
4 Circulatory system	d. transports gases through the blood vessels.

1 .... 2 .... 3 .... 4 ....



Unit 2 Getting Energy

Unit Concepts:

Concept 1 Thermal Energy and States of Matter

Concept 2 Heat Transfer

Unit Project: Zeer Pot Cooling

Unit Objectives

In this unit, we will study:

1. Thermal energy, heat transfer and temperature
2. Change of states of matter
3. Thermal expansion and thermal contraction
4. Applications of thermal expansion
5. Thermal conductors and thermal insulators
6. Ways of heat transfer
7. Properties and uses of materials

Get Started

What I Already Know

- In this unit, you will learn more about heat and energy transfer.
- When you look at the images shown, consider what you already know about how temperature, energy, and innovation go together.

1. The thermometer is measuring a hot temperature.



2. The woman is wearing an oven mitt that is a good insulator to protect her hand from extreme high temperature.

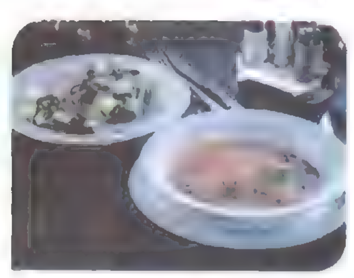


3. Finally, the woman is selecting clothing and using technology.



توضح ترمومترًا يقيس درجة حرارة ساخنة.
• الصورة [2] ترتدي المرأة قفازَيْ فرن من مادة عازلة لحماية يديها من الحرارة العالية.
[3] تختار المرأة ملابس عن طريق التكنولوجيا.

Packing Lunch for a Trip

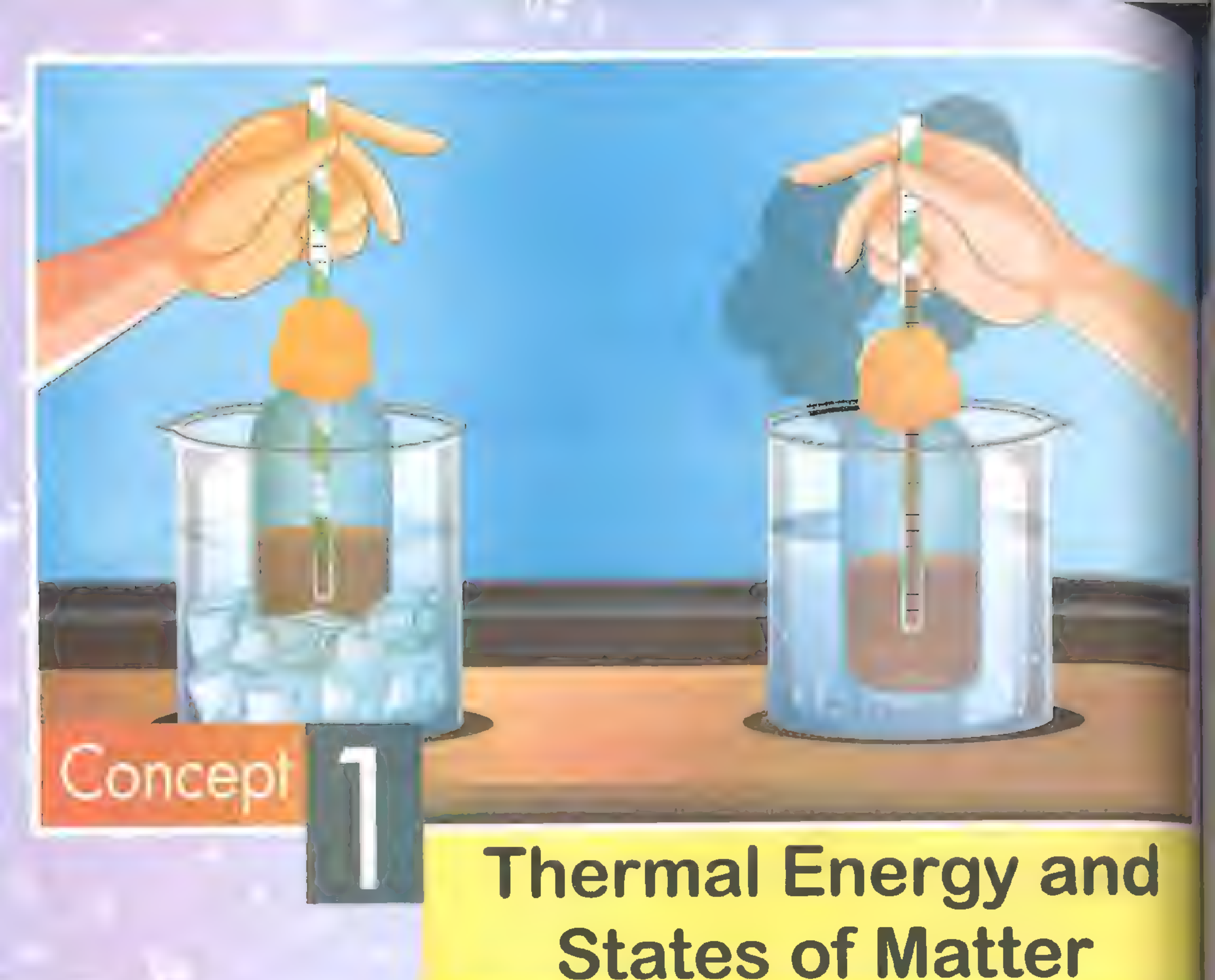


- Hanna is going on a trip. She will be traveling for many hours.
- She wants to take some food with her. She decides to pack some salad and soup.
- How can she keep her salad cold and her soup warm?

• ستذهب هناء في رحلة طويلة؛ لذا:
• ستأخذ بعض الأطعمة معها، ومن بين هذه الأطعمة السلطة والمشروبات الساخنة.
• ولكن كيف ستحافظ على درجة حرارة السلطة والشُّربة؟

At the end on this unit, you will be able to answer the following questions:

- How does heat move through substances?
- What materials can encourage or prevent heat transfer?
- How do scientists create new materials for better heat transfer or insulation?



Thermal Energy and States of Matter

Concept Objectives:

By the end of th[illegible] students will be able to:

- Construct explanations for patterns in the movement of particles in solids, liquids, and gases.
- Argue from evidence how the addition and removal of thermal energy changes the movement of particles and the state of matter.
- Construct explanations of the relationships among temperature, heat transfer, and thermal energy.
- Model the relationship between kinetic energy of particles and temperature.
- Conduct an investigation to determine the effect of changing temperature on particles movement in a thermometer.

Key Vocabulary:

- Atom
- Matter
- Molecule
- Temperature
- Thermal energy
- Kinetic energy
- Condensation
- Contraction
- Expansion
- Heat

Concept 1

Thermal Energy in States of Matter



Lesson 1





Activity 1 Can You Explain?

Look at the thermal pool in the photo.
Can you observe matter changing state?



- The water in the thermal pool is changing into steam.
- The water is heated by magma underground.

• يتحول الماء الموجود في ينبوع الماء الساخن إلى بخار.
• الماء يكون ساخنًا جدًّا بسبب الصخور المنصهرة تحت الأرض.

Matter It is anything that has mass and takes up space.

» Any matter consists of tiny, moving particles (molecules or atoms).
» Matter around us often changes from one state to another.
» Thermal energy, heat transfer and temperature are involved in these changes.

المادة: هي أي شيء له كتلة ويشغل حيزًا من الفراغ.
• أي مادة تتكون من جسيمات صغيرة في حالة حركة.
• كثيرًا ما تتغير المادة من حولنا من حالة إلى أخرى.
• تحدث هذه التغيرات بسبب الطاقة الحرارية ودرجة الحرارة وكيفية انتقالها.

What happens if...

1 The substance is heated?

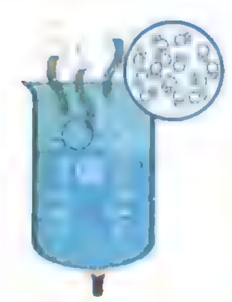
- The thermal energy of the particles in a substance increases.

2 The substance is cooled?

- The thermal energy of the particles in a substance decreases.

Thermal (Heat) Energy:

» It is the total sum of the kinetic energy of a substance's atoms and molecules.



Heat Transfer:

» It is the energy transferred from the body of higher temperature to the body of lower temperature.



Temperature:

» It is a measure of the average kinetic energy of the atoms and molecules in a substance.



- [illegible] هي مجموع الطاقة الحركية لذرات وجزيئات المادة.
- انتقال الحرارة: هو انتقال الطاقة الحرارية من الجسم ذي الحرارة الأعلى إلى الجسم ذي الحرارة المنخفضة.
- درجة الحرارة: هي مقياس لمتوسط الطاقة الحركية للذرات والجزيئات الموجودة في المادة.



Check your understanding?

Put (✓) or (✗):

- The thermal energy of the particles in a substance increases by cooling. (   )
- The state of matter is affected by the temperature. (   )
- (   )

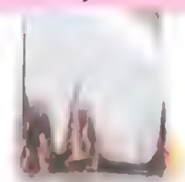


Activity  Glassblowing

Heat could be used in

Changing the state	Changing the matter	Shaping the matter
When an ice cube is heated, it melts.	When a paper is heated, it burns.	Heat is used to shape and form glass.







Glassblowing

A long time ago, people discovered that:

- Glass could be blown from the open end of a hollow tube and turned into different shapes using very high heat.

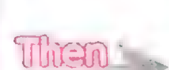


How does glassblowing happen?



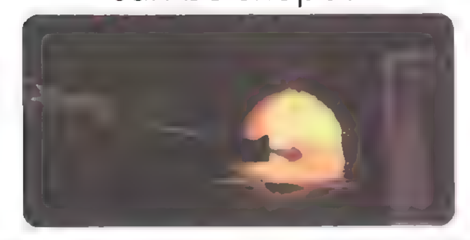
First: Heating

The material is heated in a hot furnace so it can be melted into a liquid that can be shaped.



Second: Cooling

Once the glassblower is finished, the material must be cooled back into a solid to maintain the new shape.





- لقد اكتشف الإنسان قديمًا أنه يمكن جمع كمية كبيرة من الزجاج المنصهر على طرف أنبوبة مجوفة ثم النفخ فيها، ومن ثَمَّ عمل أشكال مختلفة منه، تحت درجات حرارة مرتفعة جدًّا.

كيف يتم تشكيل الزجاج؟ • أولًا، يتم تسخين المادة في فرن ساخن بحيث يمكن صهرها وتحويلها إلى سائل يمكن تشكيله.

• ثانيًا، يتم تبريد المادة مرة أخرى إلى مادة صلبة للحفاظ على الشكل الجديد.



Give reasons for...

1. Glass can't be shaped in its solid state.
   - Because glass in the solid state has a fixed (definite) shape.

2. Glass is heated in a hot furnace to be shaped.
   - To change the glass into a liquid state that can be shaped easily.

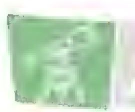
3. Glass is cooled after it is shaped.
   - To maintain the new shape because solid has a fixed shape.

Glass (Solid State) Before Shaping	Heating →	Glass (Liquid State) Shaping	Cooling →	Glass (Solid State) After Shaping

Check your understanding?

Put (✓) or (✗):

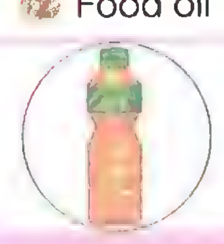
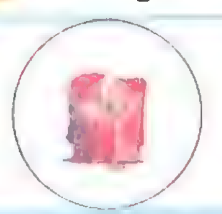
1. When liquid glass is heated, it melts. (   )
2. Heating and cooling are being used to shape glass. (   )
3. Glass can be shaped in its solid state. (   )



Activity  What Do You Already Know About Thermal Energy in States of Matter?



1 Classify the states of matter for each of the following:

 1 Pencil	 2 Food oil	 3 Melting wax	 4 Steam
			
....	....	....	....

2 Complete with the words between the brackets:

(high – variable – low – fixed)

1. The molecules within a solid are very close together and they vibrate in a .... speed.
2. Substances in the solid state have a .... volume and shape.
3. Liquid has a fixed volume but a .... shape.
4. Gas molecules are in constant motion at .... speed and therefore they are spaced far apart.

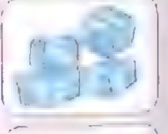
Energy of Particles:

- Almost all matter contains thermal energy.
- Thermal energy refers to the movement of particles in a substance.



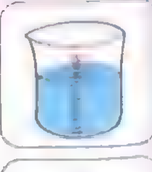
How do particles in different states of matter behave?





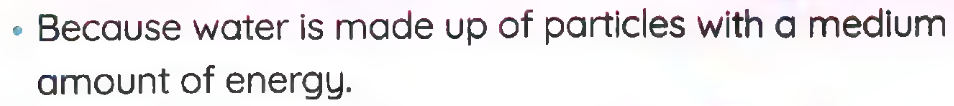
» Ice cubes have the least energy. G.R

- Because ice cubes are made of particles that move very little.

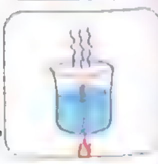




» Water in the cup has moderate energy. G.R



- Because water is made up of particles with a medium amount of energy.





» Boiling water has the most energy. G.R

- Because steam is made up of particles that move very quickly.

State	Volume	Shape	Movement of Molecules	Energy of Molecules
Solid	Fixed	Fixed	Vibrate (move very little)	Molecules have the least energy.
Liquid	Fixed	Variable	Move faster than that of solids	Molecules have a moderate energy.
Gas	Variable	Variable	Move very quickly	Molecules have the most (highest) energy.

Exercises on Lesson 1

1 Choose the correct answer:

1. Matter is made up of tiny units called ....
   a. cells b. mixtures c. compounds d. molecules
2. .... is the measure of the average kinetic energy of matter particles.
   a. Heat b. Thermometer
   c. Temperature d. Thermal energy
3. .... energy is the total sum of kinetic energy of matter atoms and molecules.
   a. Thermal b. Chemical c. Light d. Potential
4. If the atoms of a substance move slowly, it would be .... upon touching it.
   a. cold b. hot c. rough d. smooth
5. The thermal energy of the particles ...., when the substance is cooled.
   a. increases b. decreases c. becomes zero d. doesn't change
6. The total sum of kinetic energy of matter molecules at 30°C is more than that at ....
   a. 40°C b. 35°C c. 10°C d. 50°C
7. Particles of .... have the least kinetic energy.
   a. steam b. tap water c. boiling tea d. ice
8. What's the correct sequence of the glassblowing procedure?
   a. Cooling → shaping → melting b. Boiling → melting → shaping
   c. Melting → shaping → cooling d. Cooling → shaping → freezing
9. Heat is used to shape and form ....
   a. glass b. papers c. cloth d. wood
10. All the following are liquids, except ....
    a. oil b. water vapor c. rock d. melting wax
11. To reshape a candle, you need to ....
    a. turn it into solid b. melt it c. freeze it d. cool it down

2 Put (✓) or (✗):

1. When matter is cooled, the speed of its particles increases. ( )
2. We can change the shape of glass by heating only. ( )
3. When ice cubes are heated, they melt. ( )
4. It is hard to shape glass in the solid state because it has a definite shape. ( )
5. Some matters only contain thermal energy. ( )
6. The substance state changes by changing its temperature. ( )
7. A glass of water has a moderate thermal energy. ( )
8. On boiling water, its particles have the lowest kinetic energy. ( )
9. On heating a piece of paper, it melts. ( )

3 Write the scientific term:

1. It is the total sum of the kinetic energy of a substance's atoms and molecules.
2. It is a measure of the average kinetic energy of the matter molecules.

4 Complete the following sentences using the words between the brackets:

(liquid – magma – shaped – furnace – boil)

1. A hot spring is created when water is heated by a .... deep within Earth, so water begins to ....
2. Glass is heated in a hot .... to be melted into a .... state that can be ....

5 Correct the underlined words:

1. All matters have **light** energy.
2. If the atoms of a substance move faster, its temperature will **decrease**.
3. When water is boiled, it turns into **solid**.
4. Glass is blown and shaped after being **cooled**.

6 Cross out the odd word:

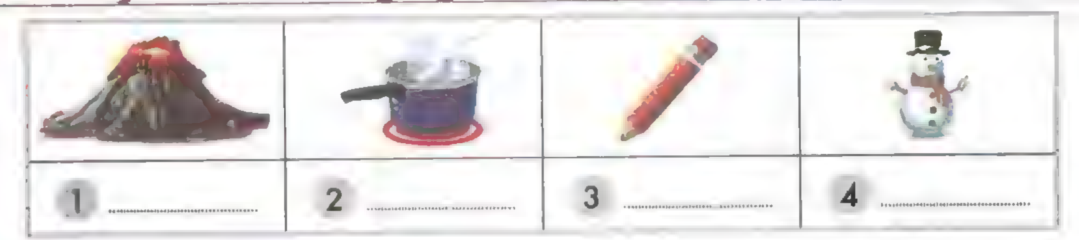
- Steam – Ice – Rocks – Glass

7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Glassblowing	a. move very little as they are packed closely.
2 Ice particles	b. have the most thermal energy.
3 Steam particles	c. have moderate energy.
4 Molten lava particles	d. is blowing air into a liquid glass to be shaped.

1 .... 2 .... 3 .... 4 ....

8 Classify the following figures into different states of matter:



1	2	3	4 ....

9 Give reasons for:

1. The water in a pool changes into steam.
   ....
2. All matter contains thermal energy.
   ....
3. Glass must be turned into liquid to be shaped.
   ....
4. Ice cubes have the least energy, while the boiling water has the most energy.
   ....
5. After glass is shaped, it must be cooled back.
   ....

10 What happens if:

1. You heat a piece of paper?
   ....
2. An ice cube is heated (according to the change of state)?
   ....
3. You boil an amount of water (according to the energy of particles)?
   ....









Activity 4 Thermal Energy, Heat Transfer and Temperature

» Previously, you learned that:

- Kinetic energy is the energy that matter gains due to its motion.

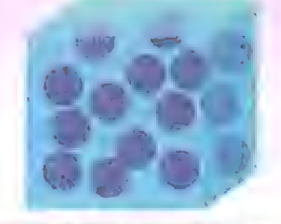
Thermal energy

It is the total sum of the kinetic energy of a substance's atoms and molecules.

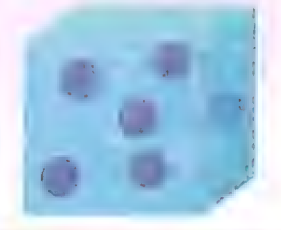
Solid — has less thermal energy than → Liquid — has less thermal energy than → Gas



Particles move a little bit



Particles move fast



Particles move very fast

» Thermal energy is a property of a system. For example, you could talk about the amount of thermal energy in a cup of hot tea.

الطاقة الحرارية:

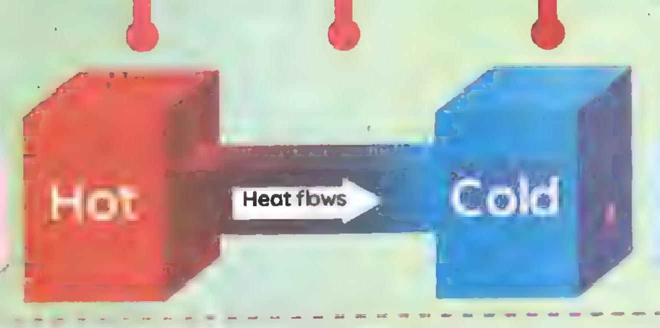
- هي مجموع الطاقة الحركية لذرات وجزيئات المادة.
- مقدار الطاقة الحرارية للمادة الصلبة أقل من المادة السائلة أقل من المادة الغازية.
- تعد الطاقة الحرارية إحدى خواص المادة. فمثلًا، يمكنك تحديد كمية الطاقة الحرارية لكوب شاي ساخن.

Heat Transfer

- It is the energy transferred from a **hot** object to a **cold** object.
- Heat transfer occurs when there is a difference in temperature between substances.
- We often describe the warmth of an object by saying that it contains heat.

• انتقال الحرارة: هي عملية انتقال الطاقة من الجسم الساخن إلى الجسم البارد.

• يحدث انتقال الحرارة بسبب اختلاف درجات الحرارة بين المواد. • غالبًا ما نصف جسمًا دافئًا بالقول: إن الجسم يحتوي على حرارة.



What happens if...



1. You hold a piece of ice cube by your hand?
   - Thermal energy transfers from your hand to the ice cube, so it melts.
2. You hold a glass of hot tea by your hand?
   - Thermal energy transfers from the hot cup of tea to your hand, so you feel hot.

There are three different ways of heat transfer:

1. Conduction
2. Convection
3. Radiation

- You will learn more about these in later studies.

• هناك ثلاث طرق مختلفة لنقل الحرارة هي: التوصيل، والحمل الحراري، والإشعاع.

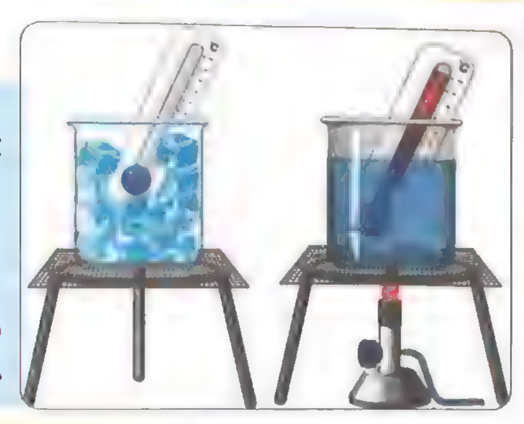


Temperature

It is a measure of the average kinetic energy of the particles (atoms and molecules) in a substance.

درجة الحرارة:

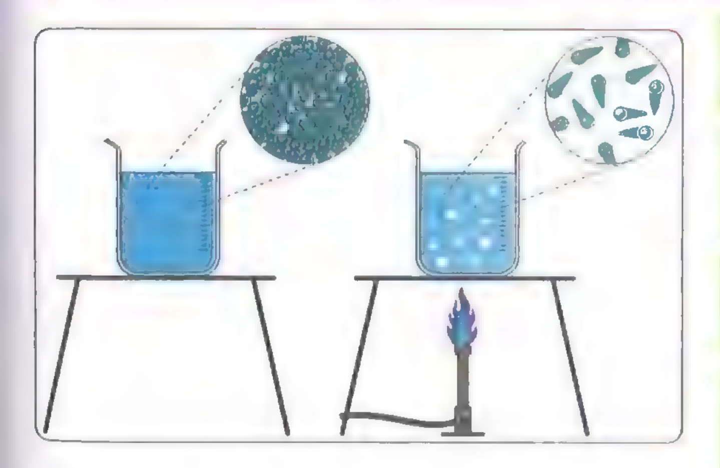
هي متوسط طاقة حركة الجسيمات (الذرات والجزيئات) في مادة ما.



Atom: It is the smallest building unit of matter.

- Temperature indicates how hot or cold a substance is.
- Temperature is measured using a thermometer.

What happens to the average energy of the particles in a substance when the substance is heated?



Thermal energy is transferred to the particles.

▼

The particles move faster as they gain energy.

▼

The average kinetic energy of particles increases.

▼

The average thermal energy of the substance increases.

عند تسخين المادة:

- تنتقل الطاقة الحرارية إلى جسيماتها.
- ومن ثم تكتسب جسيمات المادة طاقة وتتحرك بشكل أسرع.
- يزيد إجمالي طاقة حركة جسيمات المادة.
- يرتفع إجمالي الطاقة الحرارية لهذه المادة.

Check your understanding?

Put true or false:

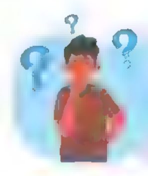
1. Heat transfers from an object with lower temperature to an object with a higher temperature. (   )
2. Heat is measured using a thermometer. (   )



Activity 5 Change of State of Matter



- Objects with more thermal energy have more kinetic energy.
- How much thermal energy and kinetic energy exist in objects depends on the speed of molecules.
- The state of matter is related to its thermal energy.



How does temperature affect the physical state of different substances?



1 Heating



Adding thermal energy that causes

Melting

It is the change of matter from a solid state to a liquid state by heating.

As a solid is heated,

- Its particles vibrate faster and faster and move farther apart.
- Their energy becomes great enough to overcome the forces that hold them in place, so melting occurs.

- عند ارتفاع درجة حرارة مادة صلبة، تهتز الجسيمات داخلها بسرعة أكبر، ويتباعد بعضها عن بعض.
- تصبح طاقة جسيماتها كبيرة؛ مما يمكنها من التغلب على قوى الترابط بين الجسيمات، وتحدث عملية الانصهار.

Evaporation



It is the change of matter from a liquid state to a gas state by heating.

As a liquid is heated,

- Eventually, the particles have enough energy to escape and move away from each other, and the liquid vaporizes into a gas.

- عند رفع درجة حرارة مادة سائلة تكتسب جسيماتها طاقة كافية تمكنها من تباعد بعضها عن بعض، ومن ثم تتبخر المادة السائلة وتتحول إلى مادة غازية.



2 Cooling

Removing thermal energy that causes



Freezing

It is the change of matter from a liquid state to a solid state by cooling.



Condensation

It is the change of matter from a gas state to a liquid state by cooling.

- Substances boil or melt at specific temperatures.
- The melting and boiling points are physical properties of a substance.

Boiling and Melting Points

Boiling Point

- The temperature at which a liquid boils and turns to gas.

At the boiling point,

- Liquid is turned to gas (vapor).
- The molecules' movement increases, and they spread out.

The boiling point of water is 100°C.
The boiling point of mercury is 357°C.

Melting Point

- The temperature at which a solid melts and turns to liquid.

The melting point of Ice is 0°C.

- Scientists test how a change in temperature affects different substances. G.R

To determine which materials are suitable to use in tools and experiments that take place in extreme conditions.

NOTE

- Understanding how heat can cause substances to change helps us understand changes in state, weather, and even ocean currents.





Hands-on Investigation: Temperature and Particle Movement



Temperature and Particle Movement

» We will carry out an experiment to compare how quickly food coloring will spread out in hot and cold water.

Tools:



Steps:

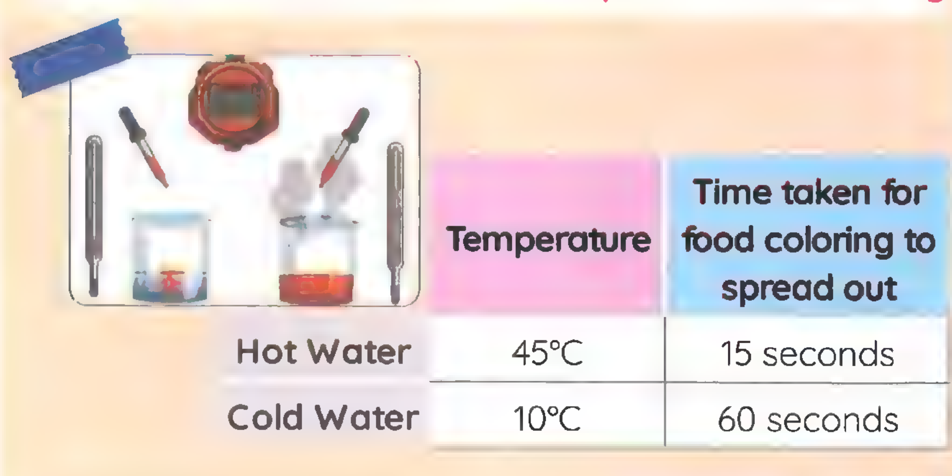
1. Add 100 mL of hot water to one beaker and 100 mL of cold water to the other beaker.
2. Record the temperature of the water in each beaker using a thermometer.
3. Add 2 drops of food coloring to the center of each beaker at the same time using the eyedroppers.
4. Start the stopwatches at the instant the food coloring is added.
5. Record your data and observations.
6. Repeat the previous steps, but using 200 mL of water and 4 drops of food coloring.

Observation:

- The red color spread out in the hot water faster than in the cold water.
- The 2 drops of dye were spread out in 100 mL at the same time as the 4 drops of dye were spread out in 200 mL of water.



Trial 1: 100 mL of water + 2 drops of food coloring



	Temperature	Time taken for food coloring to spread out
Hot Water	45°C	15 seconds
Cold Water	10°C	60 seconds

Trial 2: 200 mL of water + 4 drops of food coloring



	Temperature	Time taken for food coloring to spread out
Hot Water	45°C	35 seconds
Cold Water	10°C	140 seconds

Conclusion:

- If the temperature increases, the kinetic energy of the particles will increase, the particles will move faster and the dye spreads faster.
- If the temperature decreases, the kinetic energy of the particles will decrease, the particles will move slower and the dye spreads slower.



- The colorless dyes also spread out in water, but we can't see them.

Dispersal of Compound Dyes in Water:

Depends on

- Thermal energy:
  Dyes disperse faster in hot water than in cold water.
- Amount of water:
  Dyes disperse faster in small amounts of water than in large amounts of water.

Doesn't depend on

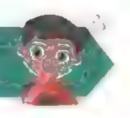
- The color:
  The colorless dyes also spread out in hot water faster than in cold water, but we can't see them.

Give reasons for...



1. Dye compounds spread out when you add them to water.
   Because dye compounds consist of tiny and moving particles.
2. The dye disperses faster when the temperature is higher.
   Because the molecules in the warm water have more kinetic energy and move faster, so the dye took a shorter time to disperse.

Check your understanding?



Put true or false:

1. Understanding particle movement helps us understand the behavior of matter. ( )
2. Particles respond to heat by speeding up or slowing down. ( )

Exercises on Lessons 2 and 3

1 Choose the correct answer:

1. Particles inside .... have more energy than ice and less than steam.
   a. helium b. wood c. water d. plastic
2. .... is the energy of motion.
   a. Kinetic b. Light c. Sound d. Chemical
3. When ice melts, ...
   a. it changes into steam b. its particles move slower
   c. it loses energy d. its particles move faster
4. A .... is used to measure an object's temperature.
   a. measuring cup b. galvanometer c. thermometer d. balance
5. When an object of a temperature of 50°c touches another object of .... , it will lose energy.
   a. 50°c b. 30°c c. 60°c d. 100°c
6. All the following are ways of heat transfer, except ....
   a. conduction b. convection c. radiation d. condensation
7. During .... and ...., matter gains thermal energy.
   a. condensation – evaporation b. melting – freezing
   c. freezing – condensation d. melting – evaporation
8. When water vapor ...., it turns into water drops.
   a. melts b. evaporates c. condenses d. freezes
9. .... is the process of changing liquid into gas by heating.
   a. Melting b. Freezing c. Evaporation d. Condensation
10. .... has the highest boiling point.
    a. Methanol b. Mercury c. Water d. Milk
11. All the following are liquids, except ....
    a. mercury b. water c. food oil d. iron
12. On ...., there's energy added to the matter.
    a. melting b. evaporation c. freezing d. a and b
13. A red food coloring spread out at the slowest rate in a water temperature of ....
    a. 60°c b. 23°c c. 40°c c. 45°c

14 A dye takes a shorter time to spread out in .... of water.
a. 100 mL   b. 200 mL   c. 250 mL   d. 300 mL

15 Dispersing a dye in 100 mL of hot water takes 10 seconds, so it will take .... to spread in 100 mL of cold water.
a. 5 seconds   b. 10 seconds   c. 30 seconds   d. 9 seconds

16 The dispersal rate of a dye in an amount of water depends on the ....
a. amount of water   b. water temperature
c. dye color   d. a and b

17 As the temperature of water decreases, ...
a. its particles move faster
b. its particles kinetic energy increases
c. dye disperse faster
d. its particles thermal energy decreases

2 Put (✓) or (✗):

1 Thermal energy comes from the movement of matter particles. (   )
2 Particles in liquids have less energy than particles in gases. (   )
3 When solid matter particles gain energy, they vibrate faster. (   )
4 The state of matter depends on its thermal energy. (   )
5 Particles of matter need to gain energy to overcome forces among them. (   )
6 Heating a sample of matter means the removal of thermal energy. (   )
7 Condensation is the process of changing gas into liquid by heating. (   )
8 The thermal energy of an object depends on the speed of its molecules. (   )
9 Mercury has a higher boiling point than that of water. (   )
10 The dispersal of a dye in water depends on the dye's color. (   )
11 A dye takes a longer time to spread in hot water. (   )
12 When adding a colorless compound to water, it doesn't disperse as we don't see it. (   )
13 Fast-moving particles take a shorter time to spread out in water than slow-moving ones. (   )
14 Red food coloring spreads out in cold water faster than a blue one. (   )
15 A dye spreads out in a small amount of water faster than a larger amount of it. (   )
16 The warmer the particles, the faster they move around. (   )

3 Write the scientific term:

1. It is the total sum of the kinetic energy of a substance's atoms and molecules.
2. It is the amount of thermal energy transferred from one substance to another.
3. It is an indicator of how hot or cold a substance is.
4. A tool that is used to measure the temperature of a substance.
5. It is the change of matter from a solid state to a liquid state by heating.
6. It is the change of matter from a liquid state to a gas state by heating.
7. It is the change of matter from a liquid state to a solid state by cooling.
8. It is the change of matter from a gas state to a liquid state by cooling.
9. It is the temperature at which the liquid turns into a gas.
10. It is the temperature at which the solid turns into a liquid.

4 Correct the underlined words:

1. The particles of the substance move **slower** when they gain energy.
2. Particles of steam move **less** freely than those of water.
3. Particles of liquid move faster, spread out on heating, and turn into **solids**.
4. Melting points and boiling points are **chemical** properties of a substance.
5. The particles of **liquids** are packed tightly and vibrate in their places.

5 Complete the following sentences using the words between the brackets:

A (weather – boiling – bump – molecules – ocean currents)

1. At the .... point, the matter changes from liquid into gas.
2. In nature, heat causes changes in the .... and ....
3. Thermal energy causes .... to move around and .... into one another.

B (faster – slower – particles – decrease – thermal energy)

1. All compounds of matter consist of ....
2. Sugar particles spread out in a hot cup of tea .... than in an iced one.
3. A colorless compound would spread out .... in cold water than in warm water.

4 Red food coloring will spread faster out in hot water, because its particles have more ....

5 When adding some drops of a dye to a beaker of water and putting it in a freezer, the dispersal rate of the dye will ....

6 Choose from column (A) what suits it in column (B):

A

Column (A)	Column (B)
1 Heating ice	a. transfers from hotter to colder object.
2 Mercury	b. its particles vibrate faster and move farther apart.
3 Heat	c. is required to change a gas into a liquid.
4 Cooling	d. vaporizes at 357°c.

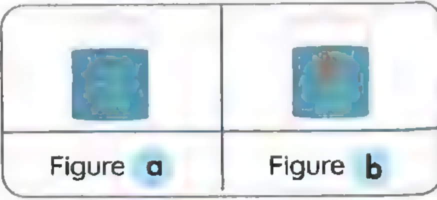
1 .... 2 .... 3 .... 4 ....

B

Column (A)	Column (B)
1 A dye compound disperses in water because	a. a dye will spread out slower in it.
2 When adding ice cubes to a beaker of water	b. the dye will spread out faster in it.
3 On decreasing the amount of water in a beaker	c. it composes of moving particles.

1 .... 2 .... 3 ....

7 At the opposite figures:



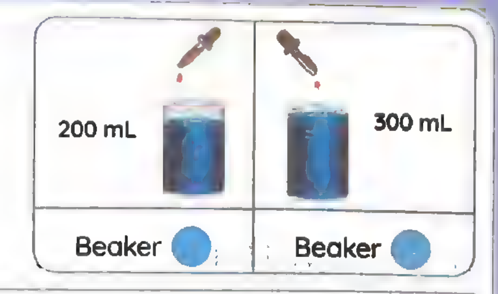
A When putting some food coloring to a beaker containing water:

1 Figure (........) represents food coloring dispersal after 2 seconds.

2 Figure (........) represents food coloring dispersal after 5 seconds, while dye particle spread forming a ....

(pattern – unsystematic colors).

B When adding a red food coloring to water in 2 beakers (a) and (b), in which beaker the dye will spread out faster? ....



Give reasons for:

- Heat is transferred from one substance to another.

  ....

- The ice melts if you hold it in your hand.

  ....

- Thermal energy is required to convert a liquid into gaseous matter.

  ....

- Thermal energy depends on the speed of the molecules of matter.

  ....

- Dye compound spreads out when adding it to water.

  ....

- The particles of dye spread out in the hot water faster than in the cold water.

  ....

What happens if:

- You hold a cup of tea in your hand?

  ....

- Two objects with the same temperature touch each other?

  ....

- A solid substance is heated. (concerning the movement of the particles)?

  ....

- You added a colorless compound to the hot and cold water?

  ....

- Increasing the thermal energy of water. (according to the movement of particles)?

  ....

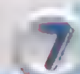
- Particles of a dye compound were static?

  ....



Lesson 4





Activity 7 Thermal Energy and Particle Movement

- Matter is always changing from one state to another.
- All changes in state require a change in temperature.

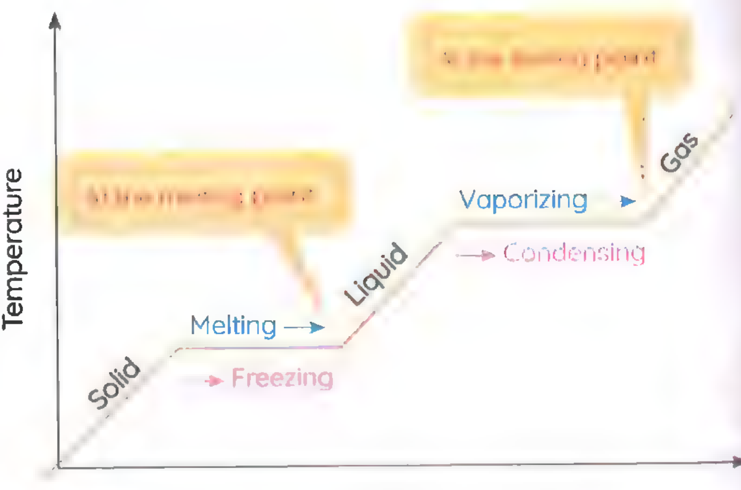
Example: A beaker of ice was heated at a constant temperature until the ice melted, boiled, and then evaporated.

Melting Point

The temperature at which the substance changes from a solid state to a liquid state.

Boiling Point

The temperature at which the substance changes from a liquid state to a gas state.



NOTES:

- The melting point of ice is 0 °C
- The boiling point of water is 100 °C

Check your understanding?



Complete the following sentence with words between brackets:

(kinetic energy – boiling point – melting point – heat energy)

1. The .... is gained by water molecules is changed into ....
2. At the ...., water changes from solid to liquid state.
3. By increasing the degree to the ...., liquid water molecules spread out so far apart and becomes gas or water vapor.



Activity  Thermal Expansion



» Have you ever tried to kick a rubber ball on a cold day?
A ball seems to lose air, making it less bouncy.

• هل سبق لك أن حاولت ركل كرة مطاطية في يوم بارد؟
يمكن أن تبدو الكرة أحيانًا وكأنها تفقد الهواء؛ مما يقلل من قدرتها على الارتداد.

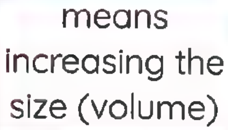
» Molecules in matter behave differently when they are warm than when they are cold.

» Cold molecules are packed more tightly together than warm molecules, which tend to spread out.

» The way that molecules are arranged is known as expansion and contraction.

• الجزيئات المكونة للمادة يختلف شكلها ومستوى ترابطها في الحالة الدافئة عن الحالة الباردة.
• غالبًا ما يكون مستوى ترابط الجزيئات في درجة الحرارة المنخفضة أكبر من مستوى ترابطها في درجة الحرارة المرتفعة؛ لأن الجزيئات تميل إلى الانتشار إذا تعرضت لدرجات حرارة مرتفعة.
• تُعرف التغيرات التي تحدث للمادة بسبب اختلاف شكل ترتيب الجزيئات المكونة لها باسم التمدد والانكماش.

Thermal Expansion	Thermal Contraction
A change that occurs to molecules of the substance produces an increase in their movement, so they spread out or expand.	A change that occurs to molecules of the substance produces a decrease in their movement so they come together or contract.



Expansion means increasing the size (volume)



Cold water

Contraction means decreasing the size (volume)

التمدد الحراري: هو التغير الذي يحدث لجزيئات المادة وينتج عنه زيادة حركتها وبالتالي يبتعد بعضها عن بعض.
الانكماش الحراري: هو التغير الذي يحدث لجزيئات المادة وينتج عنه نقص حركتها وبالتالي يقترب بعضها من بعض.

Applications on Expansion and Contraction

Thermometer:

- Many thermometers contain colored alcohol.
- What happens when you put a thermometer in substances of different temperatures?
  1. Thermal expansion occurs as the liquid in the thermometer is heated.
  2. Thermal contraction occurs as the liquid in the thermometer is cooled.



• يحتوي الكثير من الترمومترات على الكحول الممزوج بلون.
• ماذا يحدث عند وضع مقياس الحرارة «الترمومتر» في مواد ذات درجات حرارة مختلفة؟
– يحدث التمدد الحراري عند تسخين السائل الموجود في «الترمومتر». – يحدث الانكماش الحراري عندما يبرد السائل الموجود في «الترمومتر».

- Hot running water may help us open a jar lid that becomes stuck.
  As the jar's lid is heated, the metal in the lid expands, making it looser.



• قد تساعدنا المياه الساخنة على فتح غطاء البرطمان عندما يصبح عالقًا.
عندما يتم تسخين غطاء البرطمان، يتمدد المعدن الموجود في غطاء البرطمان؛ مما يجعله أكثر مرونة في الفتح.

- Bridges and other structures are often built with expansion joints.
  - As the bridge is heated, the metal making up the bridge expands.
  - The expansion joints allow this to occur safely without causing the bridge to buckle.



• غالبًا ما تراعى فواصل التمدد عند بناء الجسور والهياكل الأخرى. • عندما تزداد درجة حرارة الجسر، يتمدد المعدن الذي يتكون منه الجسر.
• وبالتالي تسمح هذه الوصلات التمدد بأمان، دون التسبب في اعوجاج الجسر.

Exercises on Lesson 4

1 Choose the correct answer:

1. On heating ice cubes, absorbed .... energy by molecules changes into .... energy.
   a. kinetic - heat
   b. heat - kinetic
   c. heat – electric
   d. heat - light
2. At the boiling point of water, all the following changes occur, except ....
   a. forces between molecules get weaker.
   b. molecules spread so far apart
   c. water changes into gas
   d. water changes into solid
3. On heating molecules of a solid matter, they will ....
   a. slow down
   b. contract
   c. expand
   d. shrink
4. The liquid in a thermometer .... as the temperature increases.
   a. contracts
   b. expands
   c. disappears
   d. freezes
5. Train tracks and bridge joints are designed to allow extra space for ....
   a. condensation
   b. boiling
   c. freezing
   d. thermal expansion
6. When cooling a substance, its particles ....
   a. move slower and expand
   b. move faster and contract
   c. move slower and contract
   d. move faster and expand
7. When putting a stuck jar lid under hot running water, it ....
   a. expands
   b. contracts
   c. boils
   d. freezes

Unit 2

2 Put (✓) or (✗):

1. The boiling point is the temperature at which a substance changes from solid into liquid state. ( )
2. Only metals contract by cooling and expand by heating. ( )
3. Changing the liquid's mass by changing its temperature is the idea of making thermometers. ( )
4. A lid of a jar in the fridge needs more force to be opened than that on a table. ( )
5. Cold molecules are packed more tightly together than warm molecules. ( )
6. Particles that make up a substance are spread apart by heating. ( )
7. Bridges and other structures may buckle if there're no expansion joints. ( )
8. Thermometers contain a solid substance that contracts and expands by changing the temperature. ( )
9. When you kick a rubber ball on a cold day, it will be less bouncy. ( )
10. Water molecules at 80°C are packed more tightly than at 10°C. ( )

3 Write the scientific term:

1. The temperature at which a substance changes from a solid to a liquid state.
2. The temperature at which a substance changes from a liquid to a gaseous state.
3. It is the spreading out of substance particles as it gets warmer.
4. It is the moving particles of the substance that are getting cooler.
5. They are found in bridges to avoid expansion damages.

4 Complete the following sentences using the words between the brackets:

(differently – expansion – contraction – heating – temperature – cooling)

1. A substance expands by .... and contracts by ....
2. Thermal .... occurs as the liquid in the thermometer is cooled.
3. Molecules in matter behave .... when they are warm than when they are cold.
4. Materials expand or contract when being exposed to changes in ....

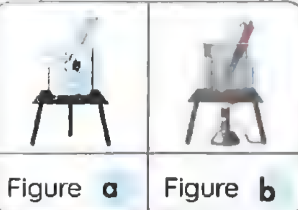
Concept 1

5 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 A thermometer	a. contracts
2 Expansion joints	b. is found in bridges to allow safe thermal expansion.
3 Rubber ball on a hot day	c. is used to measure temperature.
4 Balloon filled with air on a cold day	d. expands

1 .... 2 .... 3 .... 4 ....

6 Look at the following figures, then answer:


Figure a Figure b

In figure (........), molecules spread out and move faster than in figure (........).

On heating some ice cubes, write the number that represents the opposite graph:

1 The boiling point of water is ....

2 The melting point of ice is ....

temperature (°C)
Solid
1
Liquid
2
vapor
Time

7 Give reasons for:

1 Hot running water may help us open a stuck jar lid.

....

2 Bridges are built with expansion joints.

....

8 What happens if:

1 Heating an amount of water until it reaches its boiling point?

....

2 A jar's lid is placed under running hot water?

....

3 Bridges are built without any expansion joins?

....





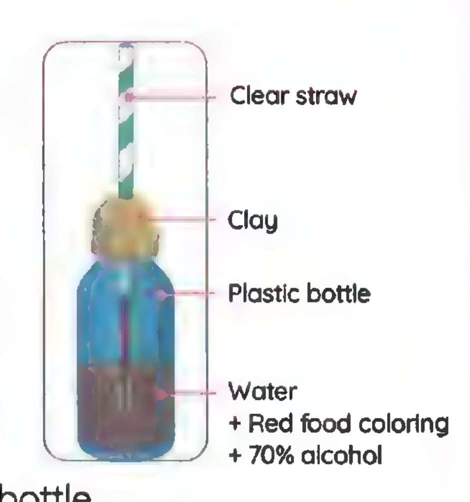
Experiment Making a Thermometer

In this activity, you will design and construct a thermometer. You will make and test predictions using your model thermometer.

Tools:



Steps:



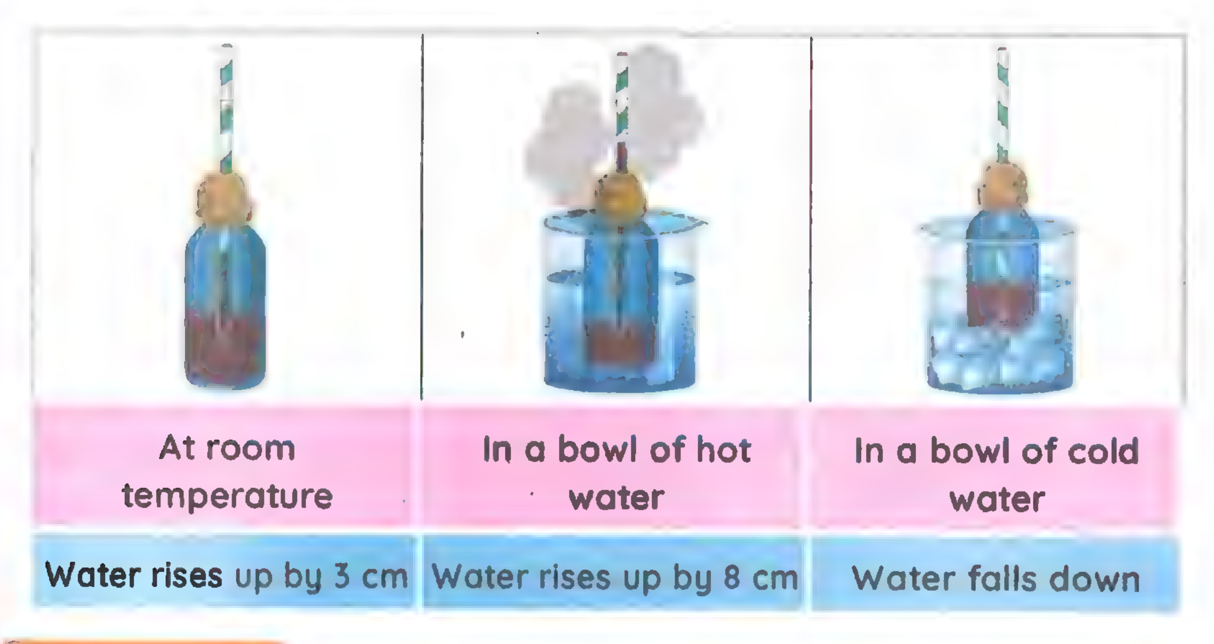
1. Pour equal amounts of water and 70% alcohol into the bottle, then add three drops of red food coloring to the plastic bottle.

2. Put the straw with the opening uncovered in the bottle, and be sure it is not touching the bottom as you wrap the clay tightly around the straw and the opening of the bottle.

3. Place the bottle on a table (room temperature), and record the height of the water in the straw.
4. Place the bottle in a bowl of hot water and record the height of the water in the straw.
5. Place the bottle into a bowl of ice water and record the height of the water in the straw.

Observation:

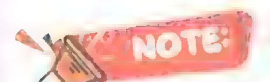
- The level of liquid in the straw rises up in a bowl of hot water.
- The level of liquid in the straw falls down in a bowl of cold water.



At room temperature	In a bowl of hot water	In a bowl of cold water
Water rises up by 3 cm	Water rises up by 8 cm	Water falls down

Conclusion:

- The main idea of a thermometer is to change the volume of liquid by changing the temperature.
- Liquids expand by heating and contract by cooling.



NOTE:

- Thermometers are used in many ways, including:

1. Assessing our health
2. Predicting the weather
3. Cooking





Activity 10 Increasing Thermal Energy

Adding Thermal Energy

The statements below describe what happens when thermal energy is added to a substance.
Complete each statement with the missing keyword.
Some words may be used more than once or not at all.

(increase - rise - expand - decrease - faster)

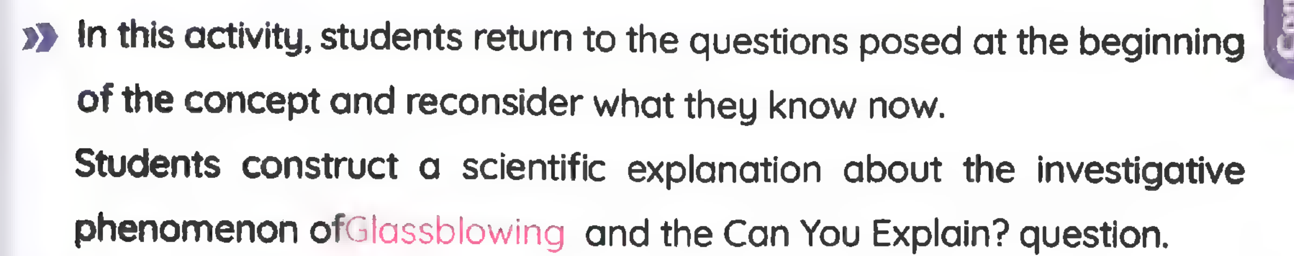
1. The particles in a substance will move .... when thermal energy is added.
2. The kinetic energy of a substance will .... when thermal energy is added.
3. The temperature of a substance will .... when thermal energy is added.
4. The substance will .... when thermal energy is added.
5. The space between particles will ....when thermal energy is added.





Activity  11 Record Evidence Like a Scientist: Circle Back: Thermal Energy in States of Matter

Concept 1



» In this activity, students return to the questions posed at the beginning of the concept and reconsider what they know now.

Students construct a scientific explanation about the investigative phenomenon of Glassblowing and the Can You Explain? question.



Question:

» **How can you describe Glassblowing now?**

My Claim:

....

....

....

Evidence:

....

....

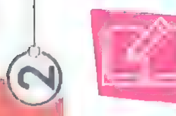
....

Scientific Explanation:

....

....

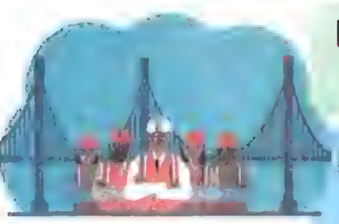
....



STEM in Action

Activity  12 Thermal Expansion Joints

» Bridges do not have a zipper, and they do not have jaws with metal teeth. Instead, they have built-in protection designed to keep the bridge from buckling in hot weather and cracking in cold weather.



Engineers use many techniques when designing bridges to make sure they stay safe over time.

Engineers apply the principles of expansion and contraction when designing structures.

- Most bridges are made of steel and concrete; these materials expand and contract when they are exposed to hot and cold temperatures.

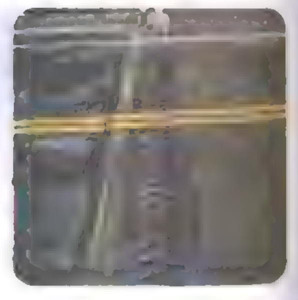
- الكباري تكون مصممة بعامل حماية مدمج للحفاظ على الكوبري من الانحناء في الطقس الحار أو التشقق في الطقس البارد.
- يطبق المهندسون مجموعة متنوعة من التقنيات عند تصميم الكباري لضمان تحقيق عنصر السلامة الدائم.
- يطبق المهندسون نفس مبادئ التمدد والانكماش عند تصميم هياكل المباني.
- تدخل مادة الصلب والخرسانة في تشييد الكباري. فعندما تتعرض هذه المواد لدرجات حرارة مرتفعة ومنخفضة، فإنها تتمدد وتنكمش.

Expansion joints:

- Expansion joints are an important engineering design feature of bridges, sidewalks, and railroad tracks.

وصلات التمدد الحراري

- تعد وصلات التمدد الحراري من الأمور الهندسية الهامة التي يجب تطبيقها عند تشييد الكباري، وعمل الأرصفة، وصنع خطوط السكك الحديدية.





NOTES!

- Increased average temperatures result in greater expansion of roads and railways.

- يؤدي ارتفاع متوسط درجات الحرارة إلى زيادة التمدد في الطرق والسكك الحديدية.

- Sun kinks are the failure of expansion in joints of roadways or train tracks.

- تتسبب حرارة الشمس في إلتواءات الطرق وقضبان السكك الحديدية.



Exercises on Lessons 5 and 6

1 Choose the correct answer:

1 In the thermometer model, the level of liquid in the straw .... in a bowl of hot water.

a. falls down b. rises up c. remains the same d. drops

2 The main idea of a thermometer is to change the .... of liquid by changing the temperature.

a. mass b. weight c. color d. volume

3 When the water molecules have less energy, they will ....

a. move closer b. move farther c. stop d. turn into gas

4 We can use the thermometer for all the following, except ....

a. assessing our health b. predicting the weather
c. cooking d. cleaning

5 On adding thermal energy to a substance, all the following occur, except that its particles ....

a. temperature rises b. spread out
c. kinetic energy increases d. take up less volume

6 .... is/are the failure in expansion of roadways' joints.

a. Sun kinks b. Sunburn c. Freezing d. Rust

7 Expansion joints are used in designing all the following, except ....

a. sidewalks b. bridges
c. railroad tracks d. thermometers

8 .... apply the principles of expansion and contraction when designing structures.

a. Doctors b. Engineers c. Biologists d. Geologists

9 Most bridges are made of .... and concrete.

a. steel b. copper c. aluminum d. nickel

Unit 2

10 When steel is exposed to hot and cold temperatures, it ....

a. expands only
b. expands and contract
c. shrinks and destroy
d. becomes stronger

11 All the following are solids, except ....

a. steel
b. alcohol
c. concrete
d. glass

2 Put (✓) or (✗):

1. Most bridges are made of iron and copper. ( )
2. Liquids expand by cooling and contract by heating. ( )
3. Thermometers are an important part of our lives.
4. When a matter is heated, its particles move slower and take up more space. ( )
5. The spaces between particles of a substance will increase on adding thermal energy. ( )
6. The kinetic energy of a substance decreases, on cooling substance particles. ( )
7. Engineers apply the principles of expansion and contraction when designing bridges and sidewalks. ( )

3 Write the scientific term:

1. A device that is used to measure the temperature.
2. The property of liquid in a thermometer that is changed by changing temperatures.
3. Features are designed in bridges to avoid hazards of thermal expansion of steel.

4 Correct the underlined words:

1. The main idea of thermometer is changing the volume of liquid by changing the **mass**.
2. In a thermometer model, the level of liquid in the straw rises up in a bowl of **cold** water.
3. To make a model of a thermometer, you need liquids as water and **iron**.

5 Complete the following sentences using the words between the brackets:

(cracking - expand - less - buckling - slower - contract - faster)

1. Liquids .... by heating, and .... by cooling.
2. On adding thermal energy, substance particles molecules will move ....
3. On cooling water, its molecules will have .... energy and they will move ....
4. Bridges are designed to avoid .... in hot weather, and .... cold weather.

6 Give reasons for:

1. Liquids take up more space by heating.

   ....

2. Bridges have built-in protection designed

   ....

3. The sun causes damage of roadways and train tracks.

   ....

7 What happens if:

1. Moving a thermometer from a cold-water cup to a warm one?

   ....

2. There're no expansion joints in bridges?

   ....

Model Exams on Concept 2.1

Model Exam 1

Question 1

(A) Choose the correct answer:

1. Matter is made up of tiny units called ....
   a. cells b. mixtures c. compounds d. molecules
2. Raising the temperature of materials can cause ....
   a. freezing and expansion b. melting and expansion
   c. melting and contraction d. condensation and contraction
3. Water changes into vapor when it reaches its .... point
   a. melting b. boiling c. freezing d. cooling
4. Expansion joints are found in all the following, except the ....
   a. sidewalks b. bridges c. railroad d. thermometer

(B) Give a reason for: Glass must be turned into a liquid to be shaped.

Question 2

(A) Put (✓) or (✗):

1. A substance's state changes by changing its temperature. ( )
2. Condensation is the process of changing gases into liquids by cooling. ( )
3. Water changes into solid at 100°C ( )
4. Metals contract by cooling and expand by heating. ( )

(B) Cross out the odd word: Mercury – Food oil – Steam – Alcohol

Question 3

(A) Complete with the words between brackets:

(hot – boiling – buckling – energy)

1. At the .... point, the matter changes from liquid into gas.
2. A red food coloring will faster spread out in .... water because its particles have more ....
3. Bridges are designed to avoid .... in hot weather

(B) What happens if:

- Moving a thermometer from a cup of hot tea to a glass of cold juice?

Model Exam 2

Question 1

(A) Choose the correct answer:

1. Most bridges are made of .... and concrete.
   a. steel b. copper c. aluminum d. nickel
2. At the boiling point of water, all the following changes occur, except ..... .
   a. that forces between molecules get weak
   b. that molecules spread so far apart
   c. that water changes into gas d. water changes into solid
3. On ...., there's energy is added to the matter.
   a. melting b. contraction c. freezing d. condensation
4. All the following are ways of heat transfer, except ....
   a. condensation b. convection c. radiation d. conduction

(B) Give a reason for: An ice cube melts when you hold it in your hand.

Question 2

(A) Put (✓) or (✗):

1. Mercury has a higher boiling point than that of water. ( )
2. A lid of a jar in the fridge need more force to be opened than a lid of another jar on the table. ( )
3. Liquids have variable volumes and fixed shapes. ( )
4. The kinetic energy of a substance increases, on cooling substance particles ( )

(B) Write the scientific term:

- It is the total sum of the kinetic energy of a substance's atoms and molecules.

Question 3

(A) Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. A thermometer	a. transfers from hotter to colder object.
2. Heat	b. is a measure of the average of the kinetic energy of substances molecules.
3. Sun kinks	c. contains alcohol mixed with a coloring matter.
4. Temperature	d. are the failure of expansion in joints of train tracks.

(B) What happens if: You add a dye to hot water?



Concept 2

Heat Transfer

Objectives:

By the end of this concept, students will be able to:

- Define the three different ways that thermal energy is transferred.
- Analyze and interpret data to explain that mass is conserved during the transfer of thermal energy.
- Construct a model and use it to investigate various materials to determine their ability to conduct and insulate heat.

Key Vocabulary:

- Calorie
- Insulator
- Insulate
- Conductor
- Conduct
- Conduction
- Convection
- Radiation
- Heat transfer
- Thermal equilibrium
- Law of Conservation of Mass

Concept 2

Heat Transfer

Lesson 1	
Activity 1	Can You Explain?
Activity 2	Ironing
Activity 3	What Do You Already Know About Heat Transfer?
Lesson 2	
Activity 4	What Is Heat?
Activity 5	Hands-on Investigation: Final Temperature
Lesson 3	
Activity 6	Conduction, Convection, and Radiation
Activity 7	Thermal Insulation and Conductivity
Lesson 4	
Activity 8	Heat Transfer in the Different Materials
Activity 9	Heat and Conservation of Mass
Lesson 5	
Activity 10	Hands-on Investigation: Design a Marble Run
Lesson 6	
Activity 11	Properties of New Materials
Activity 12	Record Evidence Like a Scientist: Circle Back: Heat Transfer





Activity  Can You Explain?

» You have learned that heat energy is transferred when two objects with different temperatures come in contact with each other.

» Look at the lizard sitting on the rock in this photo.

» Can you observe any transfers of thermal energy?



- You may not be able to see the heat, but you could feel it.
- Heat transfers from the Sun to both rock and lizard.
- Heat transfers from the warm rock to the lizard's skin.

انظر إلى السحلية وهي تجلس على الصخرة في هذه الصورة.. هل يمكنك ملاحظة أي انتقال للطاقة الحرارية؟

- قد لا تتمكن من رؤية الحرارة، ولكن قد تشعر بها.
- تنتقل الحرارة من الشمس إلى الصخرة و السحلية.
- تنتقل الحرارة من الصخرة الساخنة إلى جسم السحلية.



How would the molecules in the rock change when they were heated by the Sun?



» At first, the molecules inside the rock would move very little.

» When the rock heats up, the movement of the molecules increases.

» The molecules in the rock slow down as the heat transfer takes place, and the molecules in the lizard's skin move faster.

كيف تغيرت الجزيئات الموجودة في الصخرة عندما قامت الشمس بتسخينها؟

- في البداية، كانت الجزيئات الموجودة داخل الصخرة تتحرك قليلًا جدًا.
- عندما تم تسخين الصخرة، ازدادت حركة الجزيئات.
- تتباطأ الجزيئات الموجودة في الصخرة مع حدوث انتقال الحرارة، وتتحرك الجزيئات الموجودة في جلد السحلية بشكل أسرع.

Heat Transfer

» It is the transfer of thermal energy from an object with a higher temperature to an object with a ____ temperature when two objects come in contact.

الحرارة:

• هي انتقال الطاقة الحرارية من جسم ذي حرارة عالية إلى جسم ذي حرارة منخفضة عندما يتلامس الجسمان معًا.



Heat transfer between two objects requires:

1. Difference in temperature between two objects
2. Two objects come in contact

What happens if...



1. Two objects with different temperatures come in contact with each other?
   - Heat will transfer from the hot object to the cold object.
2. Two objects with the same temperature come in contact with each other?
   - Heat will not transfer between them.



Heat affects molecules of matter, for example:

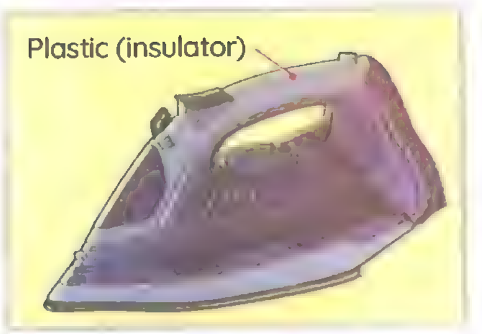
- When molecules become hotter, they move faster.
- When molecules become cooler, they move slower.



Activity  Ironing

» In ironing, heat from the iron interacts with the shirt to smooth out any wrinkles.





The handle of an iron is made of plastic. 

- Because plastic is an insulator that resists the transfer of heat energy.

What happens if... 

- The handle of an iron is made of metal?
  - Your hand will be burned because metals are good thermal conductors.

Thermal Conductors	Thermal Insulators
They are materials that allow heat to transfer easily.	They are materials that resist the transfer of heat.

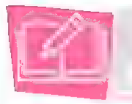
Examples:

Metals, such as: Iron - Steel - Aluminium - Brass (copper)	Wood - Plastic - Glass - Air

Check your understanding? 

Put true or false:

1. The handles of cooking pans are made of plastic or wood. (   )
2. Metals are the fastest substances at transferring heat. (   )



Activity  What Do You Already Know About Heat Transfer?

Some Properties of Heat:



1. Heat is an essential component of life on Earth.
2. Heat is not a matter; it is considered a form of energy.
3. Heat cannot be lost; it only transfers from a hotter object to a colder one.

1. الحرارة أحد المقومات الرئيسة للحياة على سطح الأرض.
2. الحرارة ليست مادة ولكنها عبارة عن نوع من أنواع الطاقة.
3. الحرارة لا تفنى، لكن تنتقل فقط من جسم إلى آخر.



NOTE:

- A blowtorch is used to melt metals so they can be shaped easily.



Give a reason for... 

- All matters have thermal energy, even if they seem cold.
  - Because the particles inside all matters are in a constant motion.

Check your understanding? 

Put true or false:

1. Heat never flows from a cool object to a warmer object. ( )
2. Water freezes at 32°C. ( )
3. Heat is a type of matter. ( )

Exercises on Lesson 1

1 Choose the correct answer:

1. Blowtorches are used to .... metals.
   a. cool b. burn c. melt d. freeze
2. Molecules of the lizard's skin will move faster when they ....
   a. are cooled b. absorb energy c. are frozen d. lose energy
3. On transferring heat from a rock to a lizard standing on it, ...
   a. the rock's molecules move faster b. the lizard's molecules move slower
   c. the rock's molecules slow down d. the rock's molecules speed up
4. The handle of an iron is made up of ....
   a. steel b. iron c. copper d. plastic
5. .... doesn't resist heat transfer through it.
   a. Plastic b. Iron c. Rubber d. Wood
6. Heat is a form of ....
   a. energy b. matter c. physical state d. metals
7. When the Sun heats up a rock, its particles will ....
   a. slow down b. speed up c. stop moving d. lose energy

2 Put (✓) or (✗):

1. On ironing your wrinkled clothes, heat transfers from the clothes to the iron. (   )
2. Most metals are thermal and electrical conductors. (   )
3. Cooking pans are made of plastic. (   )
4. The plastic handle of the iron prevents heat from reaching your hands. (   )
5. All objects, even cold ones, have thermal energy. (   )
6. Heat can be lost, but it can't be transferred. (   )
7. Heat isn't a matter. (   )
8. Metals are the fastest materials to conduct heat. (   )
9. All substances are thermal conductors. (   )

3 Write the scientific term:

1. The transfer of thermal energy from a high-temperature object to a low-temperature object.
2. Materials that allow heat to transfer through.
3. Materials that resist heat transfer.

4 Complete the following sentences using the words between the brackets:

(iron – colder – thermal energy – plastic - hotter)

1. The handle of an iron is made of .... instead of ....
2. Heat transfers from a .... object to a .... one.
3. Hot objects have more .... than colder objects.

5 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Plastic	a. is an essential component of life on Earth..
2 An iron	b. is a device used to smooth out wrinkles of clothes
3 Heat	c. loses energy, if it gets in contact with a colder object.
4 A warm object	d. is used to make handles of cooking pots and irons.

1 .... 2 .... 3 .... 4 ....

6 In the following figure:

1. The Sun heats up sand, causing its particles to move ....
   a. slower b. faster



2. Standing barefoot on a beach, you feel warm as heat transfers from ....
   a. the person's foot to the sand.
   b. the sand to the person's foot.
3. This person should wear slippers because they are thermal ....
   a. insulators b. conductors

7 Give reasons for:

1. A lizard feels warm when standing on a rock on a sunny day.
2. The handle of an iron is made of plastic.
3. All matter has thermal energy, even matter that feels cold.
4. Iron is considered a thermal conductor.

8 What happens if:

1. Two objects with the same temperature come in contact?
2. The handle of an iron is made from metal?



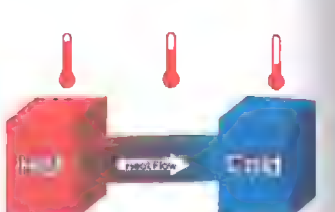




Activity 4 What Is Heat?

- All matter is composed of vibrating atoms or molecules.
- Heat never transfers from a cool object to a hotter object.
- When matter becomes warmer, the kinetic energy of its atoms or molecules increases. So, they vibrate faster.

What Is Heat?



- Heat is defined as the transfer of thermal energy from a warmer object to a cooler object.
- Heat is often measured in units called calories.

تُقاس الحرارة عادةً بوحدة تسمى السعرات الحرارية.

Uses of Heat

- We use heat at home by cooking food and taking a warm bath (shower).

Examples of Making Heat



1. Metal can be warmed by hitting it with a hammer.



2. Soup can be made warmer by putting a flame to it.

1 يمكن تسخين المعادن عن طريق الطَّرْق باستخدام مطرقة. 2 يمكن تسخين الحساء بوضعه على موقد مشتعل.

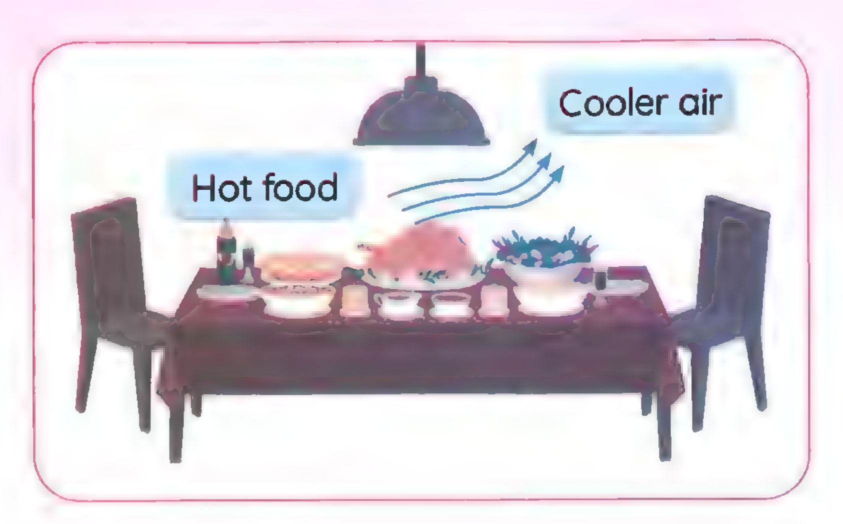
- Sometimes thermal energy transfers from one object to another. 
  - Due to the temperature difference between the two objects.



How Heat Is Transferred

When your hot dinner sits out on the table, it gets cold,

- Because heat transfers from the hot food to the cooler air around it until the food and the air have the same temperature.
- When this happens, the food and the air are said to be at thermal equilibrium.



كيف تنتقل الحرارة؟

- تبرد أطباق طعام العشاء الساخن عند وضعها على مائدة الطعام، حيث تتدفق الحرارة من الطعام الساخن إلى الهواء البارد المحيط به.
- وتستمر عملية انتقال الحرارة من الطعام إلى الهواء حتى تتساوى درجة حرارة كل منهما.
- عندما يكون الطعام والهواء في حالة اتزان حراري.

Thermal Equilibrium: It is a condition of no flow of thermal energy between two substances as they have the same temperature.

Check your understanding?



Put true or false:

- Heat never flows from a cool object to a warmer object. ( )
- Water freezes at 32°C. ( )
- Heat is a type of matter.



Unit





Activity 5 Hands-on Investigation: Final Temperature



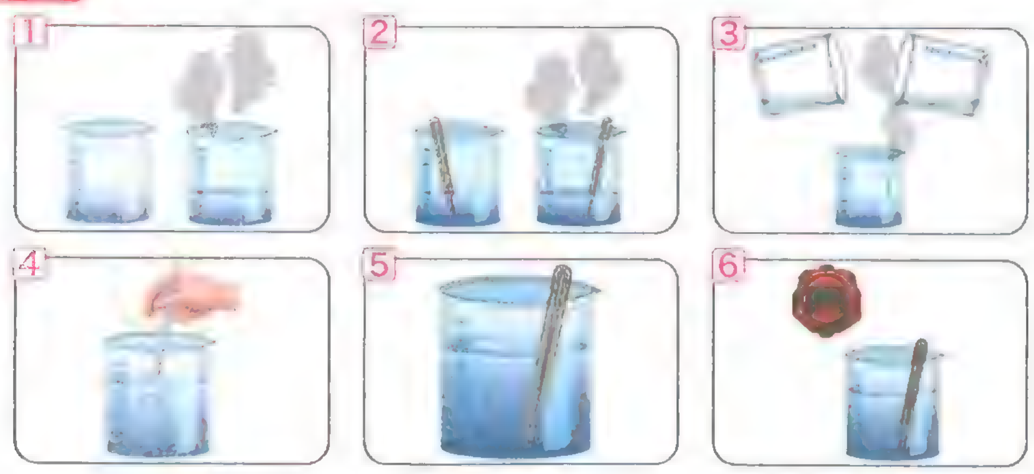
Experiment

- In this activity, you will explore thermal equilibrium.
- You will find the final temperature of the water when you mix hot and cold water together.

Tools:

3 Graduated beakers	2 Thermometers	Glass rod	Hot water	Cold water

Steps:



1. Place equal amounts of hot and cold water in two beakers.
2. Record the temperature of each beaker using a thermometer.
3. Combine the water from the two beakers into the third beaker.
4. Use the glass rod to gently mix them.
5. Measure the temperature of the third beaker.
6. Wait 3 minutes and record the final temperature of the third beaker.

Results:

Before mixing: (Temperature of beakers 1 and 2)

Temperature of hot water (in beaker 1)	50 °C
Temperature of cold water (in beaker 2)	10 °C
Average Temperature	$\frac{50 + 10}{2} = 30$ °C

After mixing: (Temperature of beaker 3)

Immediately after mixing	45 °C
After 3 minutes (final temperature)	37 °C

Observation:

- The final temperature after mixing is between the two starting temperatures.
- The final temperature was nearly the same as the average temperature.

Conclusion:

- Heat flows from the warmer object to the cooler object until the two objects have the same temperature.
- When this happens, the two objects are said to be at thermal equilibrium.

Give reasons for...



1. The final temperature is slightly lower than the average temperature.
   - Because some of the heat in the water may have transferred to the beaker and surrounding air.
2. To fix the temperature of too hot tea, we add some cold water to it.
   - The heat transfers from hot tea to cold water, lowering the temperature of the tea.

Exercises on Lesson 2

1 Choose the correct answer:

1 When matter becomes warmer, its atoms ....

a. vibrate faster
b. vibrate slower
c. stop vibrating
d. become static

2 When matter becomes cooler, the .... energy of the molecules decreases.

a. light
b. kinetic
c. magnetic
d. electrical

3 When matter becomes warmer, the kinetic energy of its molecules ....

a. decreases
b. stays constant
c. increases
d. becomes zero

4 Heat is often measured in units called ....

a. grams
b. calories
c. liters
d. meters

5 .... is the condition where two objects exchange no heat because they have the same temperature.

a. Thermal energy
b. Thermal equilibrium
c. Chemical equilibrium
d. Heat transfer

6 On leaving a bowl of warm soup on a table, its particles ....

a. gain heat from surrounding air
b. lose heat to the surrounding air
c. don't lose any heat
d. stay warm

7 On mixing liquids in the two beakers (1) and (2) as in the figure, the initial temperature of the liquid in beaker (1) may equal .... °C.

a. 50
b. 15
c. 35
d. 40

2 Put (✓) or (✗):

1 Heat never flows from a cool object to a warmer object. ( )

2 A warm soup will lose heat until it reaches the same temperature as the nearby air. ( )

3 On hitting an iron nail with a hammer, it gets cooler. ( )

4 Temperature is the energy that flows from one substance to another. ( )

5 Soup can be made warmer by putting a flame to it. ( )

6 Some heat transfers from a boiling water in a beaker to the glass of the beaker and nearby air. ( )

7 To lower the temperature of a glass of water, you add some warmer water to it. ( )

8 The final temperature is greater than the temperature of two bodies in contact. ( )

3 Write the scientific term:

1 A form of energy that transfers from a hotter object to a cooler one.

2 A condition under which there is no flow of thermal energy between two substances.

4 Complete the following sentences using the words between the brackets:

(cooler – warm bath – temperature – cooking food – thermal equilibrium – warmer)

1 In case of ...., heat doesn't flow.

2 We use heat at homes in .... and taking a ....

3 Heat flows from a .... object to a .... object until the two objects have the same ....

5 Choose from column (A) what suits it in column (B):

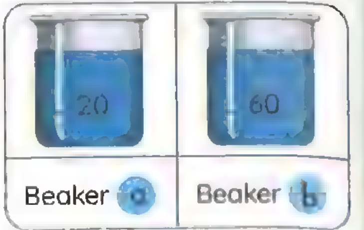
Column (A)	Column (B)
1 Final temperature	a. is the measuring tool of temperature.
2 Thermometer	b. are the measuring units of heat.
3 Fast-moving molecules	c. is slightly lower than the average temperature on mixing two liquids.
4 Calories	d. have more kinetic energy than slower ones.

1 .... 2 .... 3 .... 4 ....

Unit 2

6 In the following figures:

A On mixing the two liquids in the following figures:

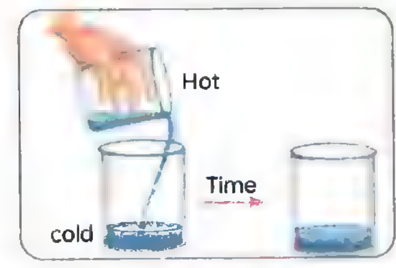


1. Their final temperature immediately after mixing will be ....
   a. 20°C b. 60 °C
   c. 45 °C d. 80 °C

2. Their final temperature after 2 minutes of mixing may equal ....
   a. 30 °C b. 60 °C c. 40 °C d. 80 °C

B **When two cups of tea, one hot and one cold, are combined together, the temperature of the new liquid is the average of the two liquids before they were mixed. What is the term that explains this scenario?**

a. Heat
b. Evaporation
c. Boiling point
d. Thermal equilibrium



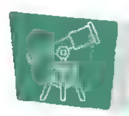
7 Give reasons for:

1. When you leave a bottle of cold water outside the fridge, it gets warmer after a while.
   ....
2. Boiling water placed in a beaker on a table gets cooler after a while.
   ....
3. When the matter becomes warmer, the molecules vibrate faster.
   ....
4. Under a thermal equilibrium condition, no heat flows between two objects.
   ....

8 What happens if:

1. When the matter becomes warmer. (concerning atoms' kinetic energy)?
2. You hit an iron nail with a hammer?





Activity  Conduction, Convection, and Radiation

» Heat energy always flows from a hot substance to a cooler substance. until the objects reach the same temperature, or equilibrium.

Heat transfer becomes faster by:

- Increasing the difference in temperature.
- Increasing the surface area.
- Increasing the length of contact.

Heat can be transferred in three ways

1. Conduction
2. Convection
3. Radiation

Conduction

Convection

Radiation

• تنتقل الحرارة من مادة ساخنة إلى مادة أقل سخونة منها، ويستمر انتقال الحرارة حتى تصل درجة الحرارة في الجسمين إلى درجة الاتزان.

• تؤثر أشياء كثيرة على معدل انتقال الحرارة، منها:

[1] الاختلاف في درجة الحرارة. [2] مساحة السطح. [3] طول مسافة التلامس.

• تنتقل الطاقة عن طريق التوصيل، أو الحمل، أو الإشعاع.

1 Conduction:

It is the direct transfer of heat from one substance to another.



- Conduction takes place between solid materials in contact.
- Conductors, such as metals, allow heat to transfer.
- Insulators, such as wood, prevent heat from being transferred.



Example:

When you have a sore muscle, a heating pad can transfer heat to the part of your body that it touches.

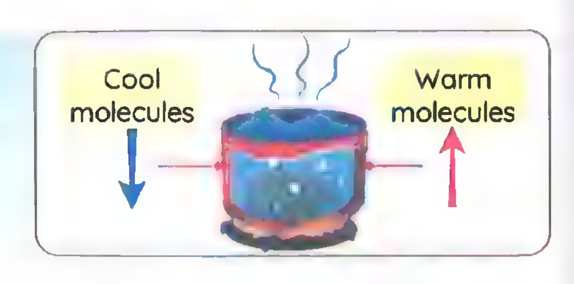
• إذا شعرت بألم العضلات، فيمكن لكمادة ساخنة نقل الحرارة إلى الجزء الملامس لها من جسمك.

2 Convection:

It is the transfer of heat due to the movement of molecules in a liquid or gas.

- Convection refers to the tendency of hotter (less dense) material to rise to the surface.
- Or the tendency of cooler (more dense) material to fall to the bottom.

Example:



The noodles are boiling in a pot.

- The noodles close to the bottom, near the heat source, get hot and rise to the surface.
- Then they cool and sink back to the bottom of the pot.

• تسخن المكرونة الموجودة بالقرب من قاع الوعاء القريب من مصدر الحرارة وتطفو على السطح، ثم تبرد وتنزل إلى أسفل الوعاء مجددًا.

Noodles rise and fall in a pot of boiling water. 

- Due to convection



Radiation:

It is the transfer of heat in space or air.

- Radiation proves that heat waves are emitted in the form of electromagnetic waves.

Examples:

1 When you lift your face to the sun and your face feels warm.	2 Holding your hands in front of a fire to warm them.
	
عندما تتعرض إلى الشمس، ترتفع درجة حرارة وجهك بفعل الإشعاع.	وضع يديك بالقرب من النار لتدفئتهما مثال آخر على الإشعاع.



NOTES!

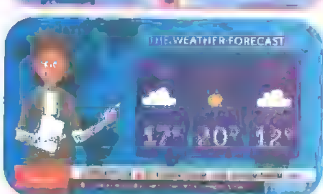
- Heat is also transferred by convection through gas molecules in air.
- The sunlight and heat of the sun reach the Earth by radiation.

Importance of understanding conduction, convection, and radiation

Scientists use their understanding of conduction to design new products, such as new cookware.



Meteorologists must understand convection and radiation to help predict the weather.



» If you wanted to design cooler, shadier sidewalks, you would need to know about conduction, convection, and radiation.

- يجب على خبراء الأرصاد الجوية فهم الحمل الحراري والإشعاع لمساعدتهم على التوصل لتوقعات الطقس.
- في حين يستعين العلماء بمعرفتهم عن توصيل الحرارة عند تصميم منتجات مثل أدوات الطهي الجديدة.
- وعند تصميم أرصفة مشاة ظليلة وباردة، يجب الاستعانة بالتوصيل، والحمل، والإشعاع.



Activity  Thermal Insulation and Conductivity

» Different materials transfer heat by conduction at different rates.

Sometimes, we want heat to transfer quickly,
like when we rub our hands together to warm them up.



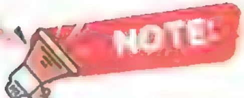


Sometimes, we want heat to transfer slowly,
like when you want to bring a hot cup of tea to a friend.

- تنتقل الحرارة عبر المواد المختلفة عن طريق توصيل الحرارة بمعدلات مختلفة.
- نرغب في بعض الأحيان أن تنتقل الحرارة بسرعة، مثلما يحدث عند فرك أيدينا ببعضها لتدفئتها.
- وفي أحيان أخرى، نفضل انتقال الحرارة ببطء مثل عند إحضار كوب شاي لأحد أصدقائك.

Conductor or Insulator?

Conductors	Insulators (poor conductors)
Definition	
• They are materials that allow heat to transfer easily through them.	• They are materials that don't allow heat to transfer easily through them.
Examples	
• Metals, such as: Brass (copper) - Iron	• Air - plastic - wood - glass



- Insulators cannot prevent some heat transfer, but they slow down the heat transfer.

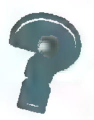
• لا يمكن حتى للمواد العازلة أن تمنع عملية انتقال الحرارة؛ لأن المواد العازلة تبطئ فقط من انتقال الحرارة.

What happens if...



1. You touch a metal bowl from outside after pouring hot soup into it?
   You would observe that the metal bowl is hot.
2. You touch a plastic bowl from outside after pouring hot soup into it?
   You would observe that the plastic bowl is just warm.

Give a reason for...





- A metal doorknob may feel cooler than a wooden door.
  - Because the metal doorknob is a conductor; it allows heat from your hand to flow more quickly.
  - While the wooden door is an insulator that resists the transfer from your hand, a metal doorknob may feel cooler than the wooden door.

مقبض الباب المعدني قد يكون أكثر برودة من الباب الخشبي المتصل به؛

• يحدث هذا لأن مقبض الباب المعدني من المواد الموصلة للحرارة حيث يسمح بمرور الحرارة.
• بينما الخشب من المواد العازلة التي لا تسمح بمرور الحرارة خلالها.
• لذا يبدو المقبض أكثر برودة من الباب الخشبي رغم أنهما في نفس درجة حرارة الغرفة.

NOTE:

- You may observe that some objects feel cool when you touch them, even though they are really at room temperature.

Exercises on Lesson 3

1 Choose the correct answer:

1. All the following are ways of heat transfer, except ....
   a. conduction b. condensation c. convection d. radiation
2. The rate of heat transfer is fastest between two objects with temperatures of .... and ....
   a. 10°C , 50°C b. 50°C , 100°C
   c. 20°C - 100°C d. 60°C , 90°C
3. Heat is transferred from one tip of a metallic spoon to the other tip by ....
   a. conduction b. condensation c. convection d. radiation
4. Heat emitted from a nearby fireplace or heater reaches our bodies through ....
   a. convection b. radiation c. conduction d. a and b
5. Sunlight and heat reach the Earth by ....
   a. convection b. radiation c. conduction d. condensation
6. .... is the transfer of heat due to the movement of liquid or gas molecules.
   a. Conduction b. Radiation c. Convection d. Freezing
7. Which type of heat transfer occurs between objects that are touching (in contact)?
   a. Boiling b. Radiation c. Convection d. Conduction
8. What is one example of heat transfer due to radiation only?
   a. When the sun shines on your face, it feels warm.
   b. When a pot of water is on the stove, it boils.
   c. When a cake is in the oven, the hot air bakes it.
   d. When you put a hot water bottle in the bed, it warms the sheets.



9 If an engineer wanted to design a product that would conduct heat well, which material would he choose?

a. Wood b. Plastic
c. Metal d. Foam

10 Substances that do not effectively transfer heat are called ....

a. insulators b. conductors
c. liquids d. solids

11 You feel cold when touching all the following except a/an ....

a. metallic spoon b. metallic door knob
c. aluminum foil d. wooden door

2 Put (✓) or (✗):

1 Heat transfers faster by decreasing the surface area of substances. ( )

2 Heat can't transfer through space. ( )

3 Heat is transferred by conduction in milk molecules and by convection in iron molecules. ( )

4 The cold water molecules are heavier than those of hot water. ( )

5 On boiling noodles, hot noodles rise to the surface of the water. ( )

6 The heat of the Sun reaches Earth's surface by radiation. ( )

7 To design cooler, shadier sidewalks, engineers must study only convection. ( )

8 Thermal energy transfer can occur in only two ways. ( )

9 Wood is considered an insulator, while metals are thermal conductors. ( )

10 Heat transfers from your skin to the wooden door slower than to its metallic knob. ( )

11 The wooden door has a higher temperature than its metallic knob in summer. ( )

3 Write the scientific term:

1. It is the direct transfer of heat from one substance to another.
2. It is the transfer of heat due to the movement of molecules in a liquid or gas.
3. It is the transfer of heat through space or air.
4. They are specialists who predict the weather.
5. They are substances that allow heat to transfer easily.
6. They are substances that don't allow heat to transfer easily.

4 Complete the following sentences using the words between the brackets:

(solid – length of contact – gas – radiation – liquid – surface area)

1. The rate of heat transfer increases by increasing the .... and ....
2. Heat transfers by convection as a result of movement of molecules of a .... or a ....
3. The heat transfers through .... substances by conduction.
4. The thermal energy from the Sun is emitted through space by ....

5 Cross out the odd word:

1. Brass – Iron – Glass – Copper
2. Air – Iron – Water – Mercury

6 Compare between the following:

P.O.C	Thermal Conductors	Thermal Insulators
Definition	....	....
Examples	....	....

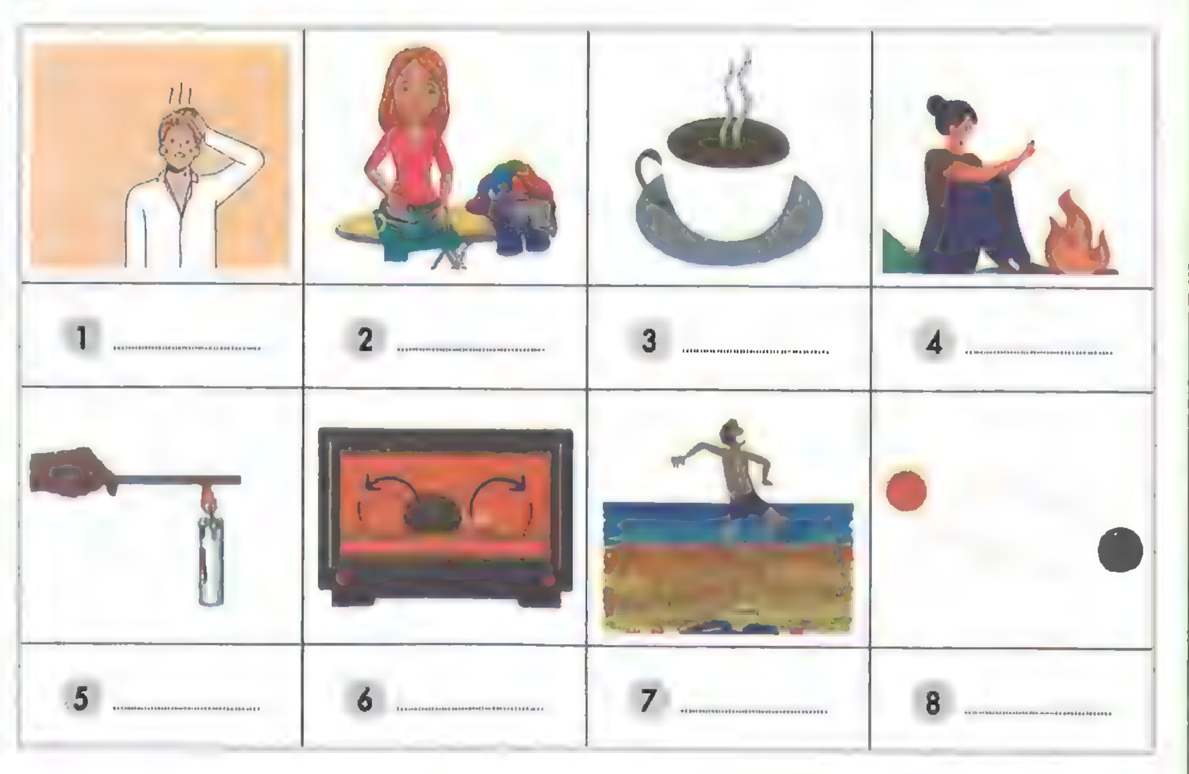
7 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Meteorologists	a. need to study convection to design new cookware.
2 Engineers	b. is the way by which heat is transferred through large distances as space.
3 Radiation	c. need to understand convection and radiation to predict weather.
4 Insulators	d. slow down the heat that transfers through them.

1 .... 2 .... 3 .... 4 ....

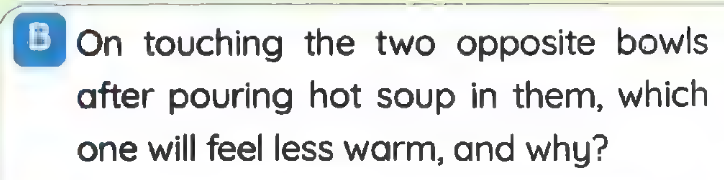
8 Look at the following figures, then answer:

A Write the suitable way(s) of heat transfer in the following:



1	2	3	4 ....
5	6	7	8 ....

Unit 2



B On touching the two opposite bowls after pouring hot soup in them, which one will feel less warm, and why?

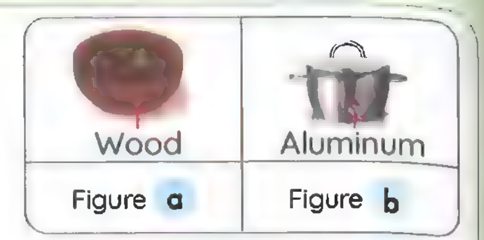


Figure a — Figure b

....



C Put (✓) or (✗):



1. Heat transfers through conduction in part Number (1). ( )
2. Hot water molecules rise up. ( )
3. The heat of the flame transfers to the surrounding air by conduction. ( )
4. Number (2) represents the heat transfer by convection. ( )

7 Give reasons for:

1. Placing a heating pad on a sore muscle in your neck.

....

2. Moving noodles up and down in boiling water.

....

3. Meteorologists need to understand convection and radiation.

....

4. A metal doorknob may feel cooler than a wooden door.

....

5. Brass is a heating conductor, while wood is an insulator.

....

6. Cooking pots are made of metal, while their handles are made of plastic.

....

8 What happens if:

1. You put your hands near a fireplace?

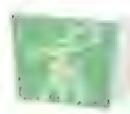
....

2. You place noodles in a pot containing boiling water?

....







Activity 3 Heat Transfer in Different Materials



Sometimes, you do not want to touch something hot in the kitchen.

What happens if...





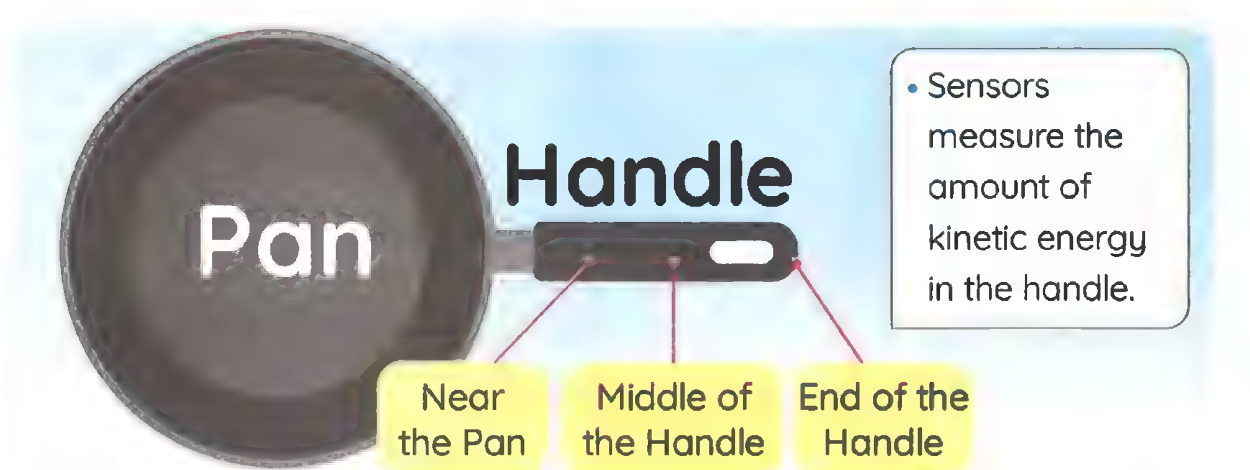
- You pick up a hot pot with a metal handle?

The metal handle could burn your hand.

Properties of handles:

1. A handle must provide the user with comfort and safety.
2. A handle must be made up of an insulator.
3. A handle must be long in length.

1 المقبض يجب أن يكون مريحًا وآمنًا عند الاستخدام.
2 يجب أن يصنع المقبض من مادة عازلة للحرارة.
3 من الأفضل أن يكون المقبض طويلًا.



- Sensors measure the amount of kinetic energy in the handle.

What happens if...

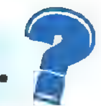


- We place three sensors along the length of the handle of a pot?

We will see three different temperatures in the three sensors.

• إذا وضعنا ثلاثة أجهزة لقياس درجة الحرارة على طول مقبض وعاء الطهي، فسنحصل على ثلاث درجات حرارة مختلفة للمقبض.

Give a reason for...



- The sensor measures different temperatures at three measuring points.
  Because heat travels along the length of the handle, so it is warmer in the part closer to the pan and cooler farther away.

» As the head of the Hot Stuff's design department, it is your job to design the handle for this pot.

» Read the following results from an experiment designed to test different materials for a pot handle.

P.O.C	Length of the Handle	Time (Min)	Temperature		
			Near the Pan (°C)	Middle of the Handle (°C)	End of the Handle (°C)
Wood	18	10	60	26	25
Plastic	18	10	54	24	23
Wood	36	10	60	25	24
Plastic	36	10	54	23	22

Now try to give your advice to make safe and comfortable handles.

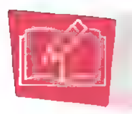
1. It is better to use .... for making handles. (plastic - wood)
2. It is better to use a handle .... centimeters long. (18 - 36)



- A thermos is used to keep liquids hot or cold, so it is coated by plastic to hold it safely.

• يستخدم الترمس للحفاظ على السوائل ساخنة أو باردة، وهو مغلف بالبلاستيك لحفظه بشكل آمن.





Activity  Heat and Conservation of Mass

» You already know that:

- Heat can be transferred from one object to another.
- This transfer of heat can lead to change the states of matter.

If you boil a pot of water on the stove and eventually there is no more water left in the pot, where did it go?

- If a liquid is heated to the point that it begins to evaporate, the matter simply changes its state. No matter is destroyed or created.

• إذا كنت تغلي وعاء من الماء فوق الموقد، ثم اختفى الماء من الوعاء. فبرأيك أين ذهب الماء؟

– عند تسخين سائل إلى درجة حرارة معينة، يبدأ السائل في التبخر، وتتغير عندها حالة المادة، فالمادة لا تفنى ولا تستحدث.

What happens if... 

- Ice is left out of the fridge (concerning the state and mass)?



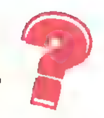
- Ice melts and changes from a solid state to a liquid state.
- The mass of the matter doesn't change.

Law of Conservation of Mass

Mass is neither created nor destroyed.

» When the state of a substance changes, its mass does not change.



What happens if... 

Unit 2

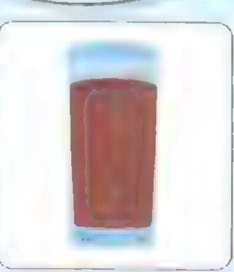
- You heat a chocolate bar (concerning the state and mass)?

- The chocolate bar melts and changes from a solid state to a liquid state.
- The mass of chocolate doesn't change.

To help you understand the Law of Conservation of Mass, read the following scenarios and try to answer the questions.

1 If the student freezes **44** g of juice, what will the mass of the student's juice pop be once it is frozen?

....





2 The popped corn does not weigh the same as the popcorn kernels. Why not?

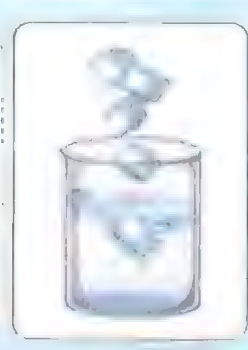
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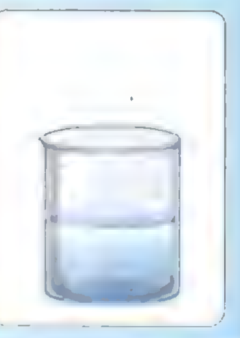




3 If the student weighs this beaker with the water and ice, do you think the combined mass will change as the ice melts? Why or why not?

....





Answers:

1 44 g

2 The popcorn kernels had some moisture in them, so when they were heated, the moisture escaped as steam.

3 No, the combined mass shouldn't change because this ice is just changing from a solid to a liquid.

Exercises on Lesson 4

1 Choose the correct answer:

1. All the following are properties of pot handles, except being ....
   a. long b. short c. made of insulators d. comfortable
2. .... and .... are preferable to make handles of cooking pots.
   a. Plastic, steel b. Plastic, copper
   c. Copper, wood d. Plastic, wood
3. The temperature at the end of a handle of a pan is .... that at the middle of it.
   a. more than b. less than c. equal to d. double
4. Heat is transferred from the pan to its handle by ....
   a. convection b. radiation c. conduction d. condensation
5. If you want to design a handle of a pan, which length is the most suitable?
   a. 10 cm b. 30 cm c. 18 cm d. 32 cm
6. On heating a substance, all the following increase, except its ....
   a. volume b. particles speed
   c. mass d. thermal energy
7. If the mass of a piece of ice is 50 g, then its mass when it melts is ....
   a. 50 g b. 25 g c. 40 g d. 60 g

2 Put (✓) or (✗):

1. Heat is transferred through plastic a bit slower than through wood. (   )
2. It is safe to hold a metallic handle of a hot pot. (   )
3. Handles of pots must be long in length and made up of conductors. (   )
4. It is better to use handles made of plastic than wood. (   )
5. Matter can be destroyed. (   )
6. The popped corn does not weigh the same as the popcorn kernels. (   )

3 Write the scientific term:

1. It's the factor that doesn't change by changing the substance temperature.
2. Energy can neither be created nor destroyed.

4 Complete the following sentences using the words between the brackets:

(state – steam – decrease – evaporate – safety – matter)

1. A handle must provide the user with comfort and ....
2. Heat transfers from a substance to another causing a change in the .... of matter.
3. If a liquid is heated to its boiling point, it begins to ....
4. After popping some corn, its mass .... a little as it loses water in the form of ....

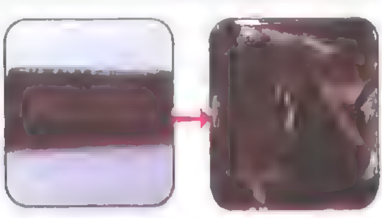
5 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 A handle of a pan	a. its mass doesn't change.
2 On changing the state of matter,	b. is made of an insulator.
3 Unpopped kernels	c. can neither be created nor destroyed.
4 Energy	d. are moist as they have water.

1 .... 2 .... 3 .... 4 ....

6 Look at the following figures, then answer:

1. When you place a 20-g chocolate bar in a pot, put the top on the pot, and place it on the stove, the chocolate bar melts. According to the Law of Conservation of Mass, after heating the chocolate, the amount of chocolate in the pot should weigh .... it did when you started.



a. a lot less than b. a lot more than c. the same as d. a little more than

2 A thermos is used to keep liquids hot or cold, so it is coated by .... (steel – plastic) to hold it safely.


Thermos

7 Give reasons for:

1 The handles of pots must be made of an insulator.

....

2 It is better to use a handle for a pot with a length of **30** cm than **20** cm.

....

3 A thermos is coated with plastic.

....

4 The popped corn does not weigh the same as the popcorn kernels.

....

8 What happens if:

1 You pick up a hot pot with its metal handle?

....

2 You heat some ice cubes (concerning the change in its state and mass)?

....

3 You place **30** grams of juice in a freezer for a while (concerning the change in its state and mass)?

....





Activity 10 Hands-on Investigation: Design a Marble Run

Experiment

» In this activity, you will make a track with hills, curves, and loops for a marble to travel down.

Tools:

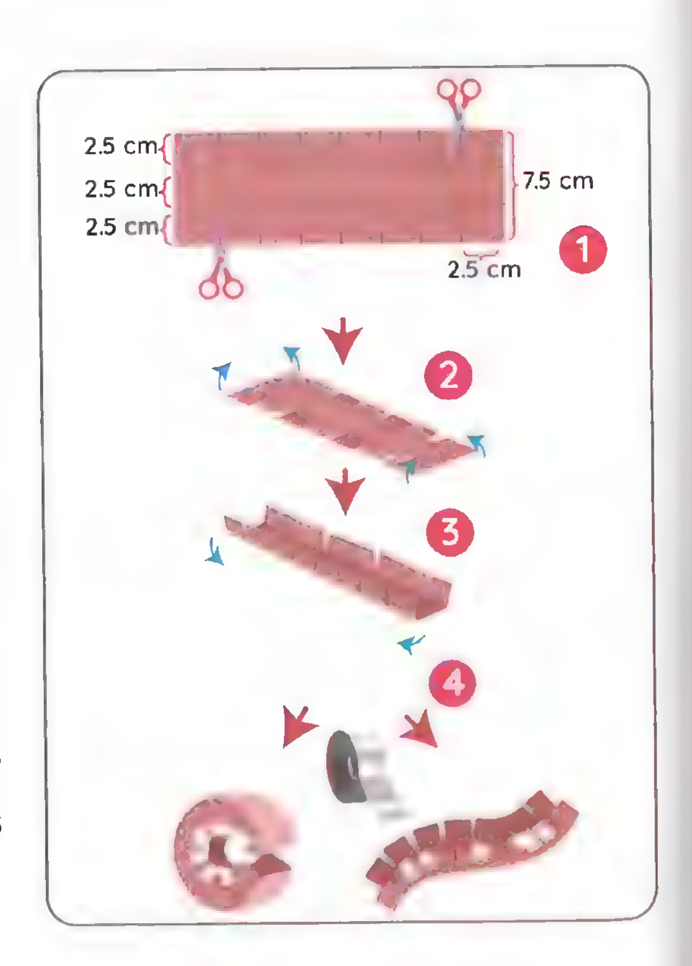
» Marble – Paper – Scissors – Tape – Pencil – Cardboard

Steps:

1. Draw a design for your track. Label the locations of potential and kinetic energy.
2. Practice building individual track segments.

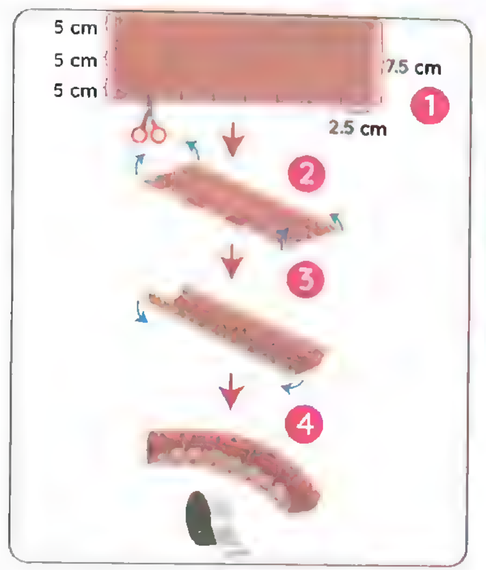
A To build a loop or hill:

i. Cut a 7.5 cm wide strip of paper.
ii. Draw two parallel lines that divide it into three 2.5 cm wide strips.
iii. Make marks every 2.5 cm along the long edges of the paper.
iv. Cut 2.5 cm towards the center from these marks to make tabs.
v. Fold the tabs up 90 degrees.
vi. Bend the track into the shape you want and tape the tabs together to hold it in place.



B To build a curve:

i. Cut a 7.5 cm wide strip of paper.
ii. Draw two parallel lines that divide it into three 2.5 cm wide strips.
iii. Make marks every 2.5 cm along the long edges of the paper.
iv. Cut 5 cm towards the center from these marks.
v. Fold up the uncut side of the paper 90 degrees to form a wall.



vi. Fold up the tabs on the other side to form the other wall.
vii. Bend it horizontally to form a curve and tape the tabs together to hold the curve in place.



» Did your marble make it all the way to the end of your track?
- My marble did not make it all the way because there was too much **friction** from the tape on the paper

» What changes would you make to your marble track to get it to go farther?
- I would make a shorter flat section and more hills.

» How are potential energy, kinetic energy, and friction related?
- My marble had the most **potential energy** at the top of the tallest hill.
- When the marble was released, the energy was transformed into **kinetic energy**.
- As the marble rolled down the paper, it rubbed against the paper and transformed some energy into heat due to **friction**.

» What do you think would happen if you used a larger marble? Why?
- The marble will roll faster down the track because it has more mass.





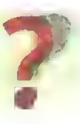
Activity 11 Properties of New Materials



» Scientists and engineers often find ways to improve or create new materials.



How are new materials created?



» When a new material is created, its properties usually differ from those of the materials used to make it.

If the new material is a mixture of other materials, then its properties will have a combination of the properties of its parts.



If the new material is the result of a chemical change, then its properties will be very different from its original materials.



• عند ابتكار مادة جديدة، تكون خصائصها عادة مختلفة عن خصائص المواد المستخدمة في صنعها.
– إذا كانت المادة الجديدة مصنوعة من خليط من مواد مختلفة، فهذا يعني أنها ستحتوي على مزيج من خواص المواد التي صنعت منها.
– إذا كانت المادة الجديدة ناتجة عن تغير كيميائي، فستكون خصائصها مختلفة تمامًا عن خواص المواد الأصلية المصنوعة منها.

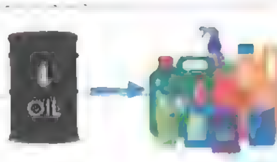
Mixture

It's a form of matter made up of two different substances or more that don't combine chemically.

Chemical change

It is the change in the structure of matter to form a new substance with new properties.

Plastic



How is it formed?	• It is made from chemical changes to some of the petroleum compounds.
Properties	• Plastic is a tough solid that often resists burning. • Petroleum is a liquid that burns easily.

• البلاستيك: – تخضع صناعته لكثير من التغيرات الكيميائية لبعض مركبات البترول.
– البلاستيك مادة صلبة تقاوم الاحتراق في حين أن البترول سائل يحترق بسهولة.



Mixing It Together

Mixing materials can produce a new material with useful properties.

Steel

How is it formed?	• It is a mixture of iron and other elements.
Properties	• Strong • Hard • Lasts for a long time

• الصلب: – يدخل في صنعه الحديد وعناصر أخرى. – هو مادة قوية، ومتينة، وتتميز بطول عمرها الافتراضي.

Concrete



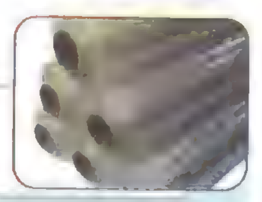
How is it formed?	• It is made of several kinds of rocks and sand that are mixed with water.
Properties	• It starts as a liquid and then hardens as it dries. • It is very strong, so it is used as the base of buildings and bridges.

• الخرسانة: – مصنوعة من عدة أنواع من الصخور والرمال المخلوطة بالماء.

– الخرسانة تبدأ في حالة سائلة ثم تتصلب بعد جفافها، وإنها قوية جدًّا؛ لذا يتم استخدامها في البنية الأساسية لتشييد المباني والكباري.

Gaining Heat

Shrink-wrap

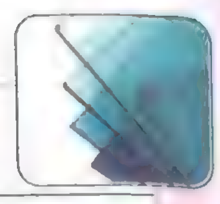


How is it formed?	• Heat is applied to plastic to make it shrink.

• صنع أنابيب الانكماش الحراري: يتم تعريض أنابيب البلاستيك للحرارة لكي تنكمش فتكون مناسبة للاستخدام.

Unit 2

Glass



Its Components	• It is made from sand with small amounts of limestone and soda ash.
How is it formed?	• The sand mixture is heated in a hot furnace. • It melts and changes into glass. • The glass hardens as it cools.

• الزجاج: – مادة الزجاج مصنوعة من الرمل وكميات صغيرة من الحجر الجيري ورماد الصودا (كربونات الصوديوم).
– عند تسخين خليط الرمل في فرن ساخن، فإنه ينصهر ويتحول إلى زجاج، ثم يتصلب هذا الزجاج عندما يبرد.

How to choose what to use:

- Scientists often develop new materials that focus on a particular set of properties of an existing material that they are interested in changing.
- For example, a scientist may be interested in developing smart clothes.

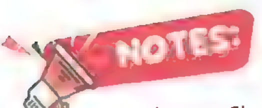
Advantages of smart clothes:

1. They're made up of flexible fabric that retains body heat.
2. They could control your body temperature.
3. They could light up in the dark.
4. They keep themselves clean.

أهمية الملابس المصنوعة من مواد ذكية:

1 صنع نسيج مرن يحتفظ بحرارة الجسم عند ارتدائه على الجلد.

2 يمكن أن تتحكم الملابس الذكية في درجة حرارة جسمك. 3 يمكن أن تضيء في الظلام. 4 يمكن أن تظل نظيفة.



- Fabric flexibility is a mechanical property.
- Retaining body heat is a thermal property.

Materials with a purpose

- In developing new materials, engineers study existing materials at molecular levels to understand their chemical structures.








Activity 12 Record Evidence Like a Scientist: Circle Back: Heat Transfer

» Now that you have learned about interactions with heat, look again at Ironing. You first saw this in Wonder.



Question:

» How can you describe Ironing now?

My Claim:

....

....

....

....

Evidence:

....

....

....

....

Scientific Explanation:

....

....

....

....

Exercises on Lessons 5 and 6

1 Choose the correct answer:

1. How is the kinetic energy of an object affected when heat is transferred to it?
   a. Kinetic energy increases.
   b. Kinetic energy decreases.
   c. Kinetic energy remains the same.
   d. Kinetic energy stops.
2. As kinetic energy is transferred in the form of heat, what happens to the movements of the molecules?
   a. The molecules move more but are arranged closer together.
   b. The molecules move less and are arranged closer together.
   c. The molecules remain unchanged.
   d. The molecules begin to move more quickly and spread out.
3. .... and engineers often find ways to improve or create new materials.
   a. Teachers b. Scientists c. Doctors d. Mechanics
4. .... is made from chemical changes to some of the petroleum compounds.
   a. Plastic b. Steel c. Glass d. Concrete
5. If iron is mixed with other elements, it will form ....
   a. plastic b. steel c. glass d. concrete
6. Both .... and .... are made from sand.
   a. steel, glass b. glass, plastic
   c. concrete, glass d. concrete, plastic
7. All the following are properties of steel, except that it ....
   a. is weak b. is hard
   c. is strong d. lasts for a long time
8. Glass is made from all the following, except ....
   a. sand b. limestone c. soda ash d. iron
9. Chassis (skeletons) of cars or bicycles can be made of ....
   a. plastic b. cloth c. steel d. glass

2 Put (✓) or (✗):

1. Plastic has different properties than those of petroleum compounds. ( )
2. When a material chemically changes, its properties will be very different from the original one. ( )
3. Steel is made up of iron only. ( )
4. Plastic is a tough solid that cannot resist burning. ( )
5. Smart clothes could light up in the dark. ( )
6. Smart clothes can't control the body temperature. ( )
7. Concrete is made from several kinds of rocks. ( )
8. When heat is applied to plastic, it expands. ( )
9. Steel lasts longer than iron as it doesn't rust. ( )

3 Write the scientific term:

1. It is made from chemical changes to some of the petroleum compounds.
2. It is a mixture of iron and other elements.
3. It is made of several kinds of rocks and sand that are mixed with water.
4. It is made from sand with small amounts of limestone and soda ash.
5. They're types of clothes made up of a flexible fabric that retains the body heat.

4 Cross out the odd word:

1. Sand – Petrol – Limestone – Soda ash
2. Rock – Water – Oil – Sand

5 Complete the following sentences using the words between the brackets:

(shrink-wrap – solid – flexible fabric – furnace – liquid – temperature – glass)

1. When a sand mixture is heated in a hot ...., it melts and changes into ....
2. Smart clothes are made up of a .... that retains the body ....
3. In .... technique, heat is applied to plastic.
4. Concrete changes from .... to .... when it dries.

Unit 2

6 Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Petroleum	a. can keep themselves clean.
2 Concrete	b. is a liquid that burns easily.
3 Smart clothes	c. produces a new material with useful properties.
4 Mixing materials	d. becomes hard as it dries.

1 .... 2 .... 3 .... 4 ....

7 Give reasons for:

1. Engineers study existing materials at molecular levels when developing new materials.

   ....

2. Concrete and bricks can't be made from cloth and the stuffing of a pillow.

   ....

3. Smart clothes are very useful.

   ....

4. Concrete is used as the base of buildings.

   ....

8 What happens if:

1. The concrete was weak?

   ....

2. Heat is applied to plastic?

   ....

3. The sand, limestone and soda ash are heated in a hot furnace?

   ....

Model Exam 1

Question 1

(A) Choose the correct answer:

1. Substances that do not effectively transfer heat are called ....
   a. insulators b. conductors c. liquids d. solids
2. On leaving a bowl of warm soup on a table, its particles ....
   a. gain heat from the surrounding air b. lose heat to the surrounding air
   c. don't lose any heat d. stay warm
3. The handle of an iron pot is made from ....
   a. steel b. iron c. copper d. plastic
4. Heat transfers from one tip of a metallic spoon to the other tip by ....
   a. conduction b. condensation c. convection d. radiation

(B) Give a reason for:

– It is better to use a handle for a pot with a length of **30** cm than **20** cm.

Question 2

(A) Put (✓) or (✗):

1. Concrete starts as a solid material. ( )
2. The heat transfers faster by decreasing the surface area of the substances. ( )
3. Soup can be made warmer by putting a flame to it. ( )
4. All substances are thermal conductors. ( )

(B) Cross out the odd word: Brass – Iron – Glass – Copper

Question 3

(A) Complete with the words between brackets:

(thermal equilibrium - iron - plastic - evaporate)

1. If a liquid is heated to a certain point, it begins to ....
2. In case of ...., heat doesn't flow as the two objects have the same temperature.
3. The handle of an iron pot is made of .... instead of ....

(B) What happens if: – The sand, limestone and soda ash are heated in a hot furnace?

Model Exam 2

Question 1

(A) Choose the correct answer:

1. When the Sun heats up a rock, its particles will ....
   a. slow down b. speed up c. stop moving d. lose energy
2. .... is the condition where two objects exchange no heat as they have the same temperature.
   a. Thermal energy b. Thermal equilibrium
   c. Chemical equilibrium d. Heat transfer
3. .... is made from chemical changes to some of the petroleum compounds.
   a. Plastic b. Steel c. Glass d. Concrete
4. All the following are properties of handles, except that they are ....
   a. long b. short c. made of insulators d. safe

(B) Give a reason for: Iron is considered a thermal conductor.

Question 2

(A) Put (✓) or (✗):

1. Heat isn't matter. ( )
2. If we mix two liquids with different temperatures, the final temperature will be between the two starting temperatures. ( )
3. Heat can't transfer through space. ( )
4. We can use the same material for different purposes. ( )

(B) Write the scientific term:

- It is the transfer of heat due to the movement of molecules of a liquid or gas.

Question 3

(A) Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1 Heat	a. have more kinetic energy than slower ones.
2 Fast-moving molecules	b. is the way by which heat is transferred through large distances, such as space.
3 Thermometer	c. is an essential component of life on Earth.
4 Radiation	d. is the measuring tool of temperature.

(B) What happens if:

- You heat some ice cubes (concerning the state and mass)?

School Book Assessment on Unit 2

1 Choose the correct answer:

1. What is thermal energy?
   a. It's the temperature of an object.
   b. It's the transfer of heat.
   c. It's the sum of the kinetic energy of the atoms and molecules in a substance.
   d. It's the mass of a substance.

2. Heat will flow from the .... substance to the .... one.
   a. hotter, colder
   b. frozen, melted
   c. colder, hotter
   d. larger, smaller

3. The temperature of a substance is defined as the average amount of .... of the molecules or other particles of a sample of matter.
   a. potential energy
   b. mass
   c. kinetic energy
   d. number

4. Objects with more thermal energy have .... kinetic energy.
   a. more
   b. less
   c. the same
   d. no

5. .... happens as a result of the separation of the particles of a substance when heat is transferred to it.
   a. Contraction
   b. Expansion
   c. Growth
   d. Freezing point

6. If you want to design a product which conducts heat well, which material will you think of?
   a. Wood
   b. Plastic
   c. Foam
   d. Metal

7. .... is the transfer of heat due to the movement of a liquid or gas.
   a. Radiation
   b. Conduction
   c. Freezing
   d. Convection

8 Which one of the following is an example of heat transfer by radiation?
a. When the Sun shines on your face, you feel warm.
b. When a pot of water is on the stove, it boils.
c. When a cake is in the oven, the hot air bakes it.
d. When you put a hot water bottle on the bed, it warms the sheets.

9 Raising the temperature of materials can cause ....
a. freezing and expansion
b. condensation and contraction
c. melting and expansion
d. melting and contraction

10 The point at which molecules in liquid water are heated and separated from each other until they become gas is called ....
a. melting point
b. freezing point
c. boiling point
d. kinetic energy

11 Which energy is generated due to the motion of particles in a certain substance?
a. Thermal energy
b. Muscular energy
c. Momentary energy
d. Potential energy

12 Which of the following may not be a source of thermal energy?
a. Micro-oven
b. Sun
c. Moon
d. Heater

13 Heat is transferred by convection in the molecules of all the following substances, except ....
a. milk
b. water
c. atmosphere
d. iron

14 Sunlight and heat reach Earth by ....
a. conduction
b. radiation
c. convection
d. a and c

15 Matter in the liquid state has a .... volume and a .... shape.
a. fixed – fixed
b. variable – fixed
c. variable – variable
d. fixed – variable

16 A .... is used to measure the temperature of materials.
a. measuring container
b. graduated cylinder
c. thermometer
d. measuring tape

2 Put (✓) or (✗):

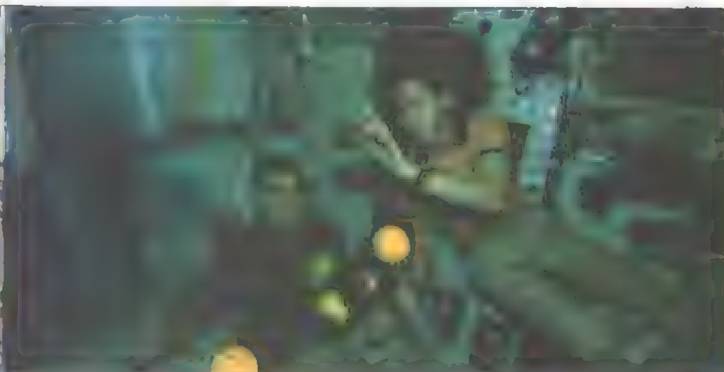
1. Heat is transferred from a substance of low temperature to a substance of higher temperature. ( )
2. When the thermal energy of the objects increases, its kinetic energy increases too. ( )
3. Freezing is the transfer of heat due to the movement of a liquid or gaseous substance. ( )
4. Thermal energy transfer can occur in only two ways. ( )
5. Sunlight and heat reaching Earth is an example of thermal radiation. ( )
6. Matter in the liquid state has a fixed volume and a variable shape. ( )
7. A measuring container is used to measure the temperature of materials. ( )
8. The final temperature is greater than the temperature of two bodies in contact. ( )
9. Thermal energy is destroyed when it is transferred from one body to another. ( )
10. Thermal energy is transferred in metals by radiation. ( )
11. The transfer of heat between the two bodies stops when the temperature of each is the same. ( )

PROJECTS



Project on Unit 1
Support System

- Space travel is unlike anything humans experience on Earth.
- The changes in gravity in space impact our body systems in many ways.
- Astronauts must be aware of these effects and take to stay safe and healthy while in space.

The Egyptian Space Agency has asked your class to design a creative new product that may help future astronauts lessen the impacts on their body systems as they spend time on the International Space Station.

What Will You Do?

1. Watch some videos about, What Space Does to the Human Body.
2. Then, read the text The Human Body without Gravity.
3. Then, discuss what you learned with your classmates.
4. Choose the body system for which you would like to design a support product.
5. Discuss the problem and how you will solve it.
6. Design your product and label all the parts of it.
7. Present your product to the class.

The Human Body without Gravity



- Once astronauts are away from Earth, they no longer experience gravity in the same way that they do on our planet. They exist in what is known as microgravity.
- Astronauts on the International Space Station are moving at more than 28,000 kilometers per hour. This means that they are constantly in free fall.
- If you have ever seen astronauts floating around in their space suits, you might be able to imagine what weightlessness might feel like.

جسم الإنسان في غياب الجاذبية

- بمجرد أن يبتعد رواد الفضاء عن الأرض، فإنهم لا يتأثرون بالجاذبية بنفس الطريقة التي كانوا يتأثرون بها على كوكبنا، بل يكونون في منطقة تعرف بالجاذبية الصغرى.
- يتحرك رواد الفضاء في محطة الفضاء الدولية بسرعة تزيد عن 28,000 كيلومتر في الساعة؛ ما يعني أنهم في حالة سقوط حر باستمرار.
- إذا سبق لك أن رأيت رواد فضاء يطفون في الفضاء ببذلاتهم الفضائية؛ فقد تتمكن من تخيل شعور انعدام الوزن.

Space Sickness

- Support systems are in place both aboard the space station and in space suits to help meet the survival needs of astronauts and combat the effects of the atmospheric conditions in space.
- However, life in space is still hard on the human body. Most astronauts experience space sickness, which feels a bit like being carsick, during a period of adjustment to the microgravity environment. Different body systems are affected in different ways.

- توجد أنظمة داعمة على متن المحطة الفضائية وفي بذلات الفضاء للمساعدة على تلبية احتياجات رواد الفضاء للبقاء على قيد الحياة ومكافحة تأثيرات الظروف المحيطة في الفضاء على أجسامهم.
- لا تزال الحياة في الفضاء صعبة على جسم الإنسان. يعاني معظم رواد الفضاء من دُوار الفضاء، الذي يشبه إلى حد ما الشعور بدوار السيارة، خلال فترة التكيف مع بيئة الجاذبية الصغرى. تتأثر أجهزة الجسم المختلفة بطرق مختلفة.

Space Sick

1 Space and the Circulatory System:

- Our hearts are used to pumping blood up to our brains against the pull of gravity.
- Gravity also helps blood flow down to our limbs and the rest of our body.
- The reduction of gravitational force in space disrupts this normal pattern.
- The disruption of this process affects the brain, eyes, skeleton, and every other organ system in the human body.

الفضاء ونظام الدورة الدموية:

- يضخ القلب الدم بصورة طبيعية إلى المخ في الاتجاه المعاكس لقوة الجاذبية .
- تساعد الجاذبية أيضًا على تدفق الدم إلى أطرافنا وبقية أجسامنا.
- انخفاض قوة الجاذبية في الفضاء يعطل هذا النمط الطبيعي.
- يؤثر اضطراب هذه العملية على المخ، والعينين، والهيكل العظمي، وكل الأعضاء الأخرى في جسم الإنسان.

2 Space and the Musculoskeletal System:



- As astronauts float around in space, their bones and muscles are also not feeling any impact.
- Eventually, an astronaut's body decides it no longer needs to build bones.
- Therefore, the structure of the bones begins to break down, or demineralize.
- In fact, astronauts can lose up to 2.5% of bone matter every month that they are in space.
- Since an astronaut's muscles are not asked to work against gravity in the same way, they also begin to lose mass, or atrophy.
- To combat these negative effects on the musculoskeletal system, astronauts must exercise for two hours and half per day.

الفضاء والجهاز الحركي

- نظرًا لأن رواد الفضاء يسبحون في الفضاء، فإن عظامهم وعضلاتهم لا تشعر أيضًا بأي تأثير.
- في النهاية، يشعر جسم رائد الفضاء بأنه لم يعد بحاجة إلى بناء العظام.
- لذا، يبدأ هيكل العظام في الضعف أو فقدان المعادن.
- في الحقيقة، يمكن أن يفقد رواد الفضاء ما يصل إلى 2.5 في المائة من المادة العظمية كل شهر في الفضاء.
- ونظرًا لأنه لا يطلب من عضلات رواد الفضاء العمل لمقاومة الجاذبية بالطريقة نفسها، تبدأ العضلات أيضًا في فقدان كتلتها أو الضمور.
- لمكافحة هذه الآثار السلبية على الجهاز الحركي، يجب على رواد الفضاء ممارسة الرياضة لمدة ساعتين ونصف يوميًا.

Project on Unit 2

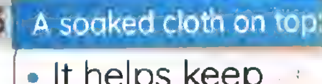
Zeer Pot Cooling

- In many parts of the world, people do not have the ability to store food for long periods of time due to the shortage of electricity.
- Zeer pot is used to keep and store food cool and fresh without using electricity.

Components of the Zeer pot:

1 Two clay pots:

- One smaller pot inside a larger pot, with the space between them filled with wet sand.



3 A soaked cloth on top:

- It helps keep the water from evaporating too quickly.

2 Wet sand:

- It provides a large surface area for water to evaporate.

• في أنحاء كثيرة من العالم، لا يملك الناس القدرة على تخزين الطعام لفترات طويلة من الزمن بسبب نقص الكهرباء.
• تستخدم الأواني الفخارية في الحفاظ على الطعام باردًا وطازجًا بدون استخدام الكهرباء.
• مكونات الإناء الفخاري:
1 إناءان من الطين، إناء صغير داخل إناء أكبر، مع وجود مساحة بينهما مملوءة بالرمال الرطبة.
2 الرمل الرطب الموجود في الإناء الفخاري يوفر مساحة كبيرة ليتبخر الماء منها.
3 القماش الموجود أعلى الإناء الفخاري يساعد على منع الماء من التبخر بسرعة كبيرة.

How does it work



- The zeer pot works by using evaporative cooling.

Evaporative cooling:

A process occurs when water evaporates due to thermal energy from the Sun, the water takes heat from the inner pot, cooling the inside as well as the contents.

كيفية عمل الأواني الفخارية:

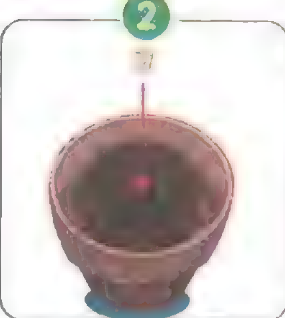
- يعمل الإناء الفخاري باستخدام التبريد التبخيري.

التبريد التبخيري:

- هو عملية تبخر الماء بسبب الطاقة الحرارية من الشمس فيأخذ الماء الحرارة من الوعاء الداخلي، فيبرد الجزء الداخلي وكذلك المحتويات.

Steps of Using Zeer Pot:









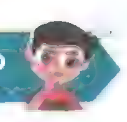
1. Get two unglazed ceramic pots, one that will fit inside the other with about 6 cm of space between the pots. Fill the bottom of the larger pot with about 5 cm of sand.
2. Place the smaller pot inside the larger one. Cover the hole in the bottom of the pot with clay or a rubber stopper.
3. Fill the space between the pots with sand. Firmly pack it down.
4. Pour water into the sand and cover the pots with a wet cloth.

1. أحضر وعاءين من الفخار غير مطليين (أحدهما يتناسب وضعه داخل الآخر مع وجود مسافة حوالي 6 سم بينهما) واملأ قاع الإناء الأكبر لارتفاع حوالي 5 سم بالرمال.
2. قم بوضع الإناء الأصغر داخل الإناء الأكبر، ثم سد الفتحة الموجودة في قاع الإناء بالطين أو بسدادة مطاطية.
3. املأ المسافة الموجودة بين الإناءين بالرمال.
4. قم بإضافة المياه إلى الرمال ثم قم بتغطية الإناءين بقطعة قماش مبللة.



The zeer pot has been tested with several different vegetables. Tests have shown that these foods can be kept fresh for the following amounts of time:

Vegetables	Time It Stays Fresh without a Zeer Pot	Time It Stays Fresh with a Zeer Pot
Tomatoes	2 days	20 days
Carrots	4 days	20 days
Okra	4 days	17 days

Check your understanding? 

Place the images in the correct sequence to show how a zeer pot is made. Add lables to explain what is happening in each image and give details of the scientific principles in use:

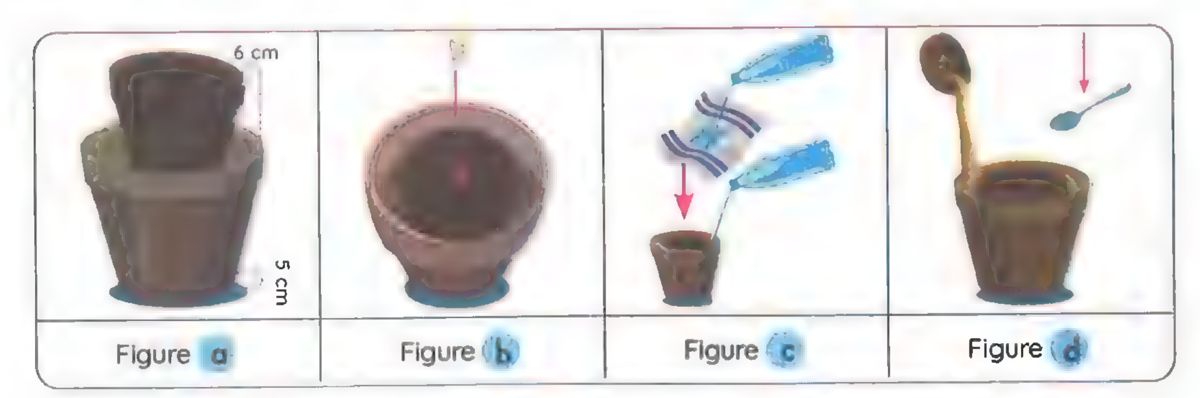


Figure a | Figure b | Figure c | Figure d

- Step 1: ....
- Step 2: ....
- Step 3: ....
- Step 4: ....



Difference between the Zeer pot and refrigerator

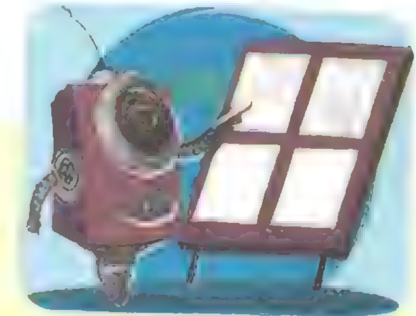


P.O.C	Refrigerator	Zeer pot
Advantages	• It keeps food at constant temperature • It can store more food	• It is easy to make. • It is low-maintenance. • It does not use electricity. • It is easily moved. • It is less costly than refrigerators. • Keeps food fresh longer than in air. • It can help address world hunger.
Disadvantages	• It is big and difficult to move. • It requires electricity. • It is costly to buy, run, and repair.	• It is small. • It uses a lot of water. • It has difficulty cooling if there is too much sunlight. • It does not work in places with high humidity. • People may need separate zeer pots for meat and vegetables.

Interdisciplinary Project

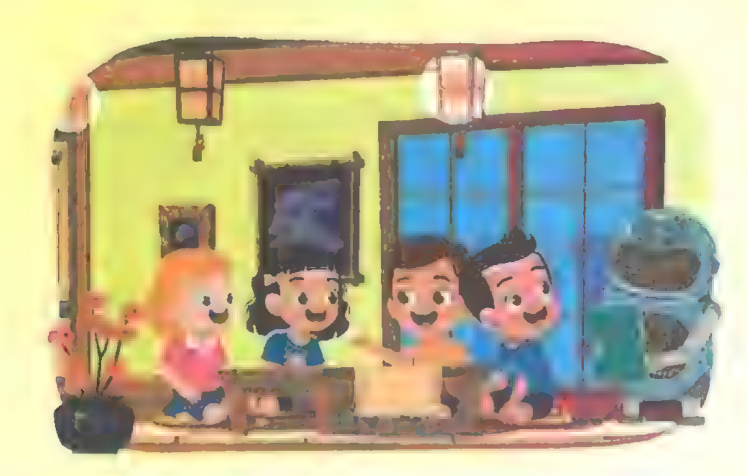
Innovate for the Future





Homework Machine:

- The STEM Solution Seekers team, Ali, Rania, Lamiaa, and Malek dream of building a homework machine. They are at a science fair in Japan. They present their project on a robot that can take orders in Japanese. After their presentation, they went to a restaurant for lunch.



- A robot waiter came to their table and took their order in English.
- The STEM Solution Seekers team was surprised and impressed.
- They startes talking about how they could build a robot that could do homework for them.
- Malek said that he could program the robot, Lamiaa could design the body, and Ali could build the circuits. They all agreed that it would be a great project.
- Before they had a chance to finish their celebration, Ali eagerly asked, "Okay, so when do we start on the robot?"

Engineering Your Solution

Identifying the Challenge

- To design a homework machine that can help you with your homework:
  - Build a prototype, documenting problems and solutions as you encounter them.
  - Think about ways the homework machine could adapt to your learning.

Objectives

- Create a list of components needed to create your design and a list of materials that will represent those components in the prototype.
- Build a prototype, documenting problems and solutions as you encounter them.

Design Requirements

- Prototype dimensions
- Homework type identification
- Part labeling
- Technology
- Presentation

Assign Group Roles

Job	Team Captain	Materials Manager	Engineer	Reporter
Role	• Encouragement and support • Helps the team members and keeps track of the timeline.	• Gather and organize materials.	• Coordinate building the model safely. • Decides when testing is needed.	• Records the steps of the process. • Shares the process.
Member Name				

Sketching Design

Engineering Design Process

1 Idea

- Sketch a detailed diagram of homework machine design.
- Decide the materials you will use in the diagram.
- Identify each major component of the machine, such as a scanner to scan homework documents.

2 Materials

Building materials, such as:

- Boxes
- Tape
- Glue
- String
- Construction paper

Optional:

- Scanner
- Circuits

3 Plan

- Gather the materials.
- Use the chosen sketch with details to be used as a blueprint for building your prototype.

4 Build

- With your teammates, begin building your prototype.
- As you build, you may run into problems or challenges.
- Focus on one problem at a time.
- Use your group's creativity and collaboration skills to find solutions.

5 Test

- Once your prototype is complete, the chief engineer should start testing the process to know whether the prototype is working perfectly or it needs improvements.

6 Improvement:

- If your prototype testing results showed that it needs any improvement, start working a reported issue with your team to create a presentation to share your product and process.

Analysis and Conclusions

- What was your role in the team?
  - ☐ Team Captain ☐ Materials Manager ☐ Engineer ☐ Reporter
- Did your design meet the requirements?
  - ☐ Yes ☐ No
- How could a homework machine help students all around the world?
  - ☐ Providing feedback on their work ☐ Saving time and reducing stress
  - ☐ Providing feedback on their work
  - ☐ Helping them focus on the more creative and challenging learning.
- What are some of the benefits of using artificial intelligence?
  - ☐ Personalized learning ☐ Providing immediate feedback
  - ☐ Sparking creativity with new ideas
- What are some of the risks of artificial intelligence?
  - ☐ Cheating ☐ Decreasing social connection
- How is the homework machine a prototype like your brain?
  - ☐ Both process information and take actions. ☐ Both make mistakes
  - ☐ Both use knowledge to generate new ideas.

Interdisciplinary Project

Artificial Intelligence

How can artificial intelligence computers be used to improve our lives?



Medicine

1 Brain Computer Interfacing (BCI):



BCI is a way to control devices with your thoughts. It occurs when a device uses signals from the brain to control something, such as:

1. The cursor on a computer



2. Finger movement as part of a prosthetic limb

2 Reviewing Individual Health Data to Develop Personalized Treatments



Supercomputers and artificial intelligence can be used:

1. To review individual health data.
2. To develop personalized treatments from the vast amount of materials available in:
   - Public databases
   - Textbooks
   - Journals

في مجال الطب:

1. التواصل بين المخ والكمبيوتر (BCI) هي طريقة للتحكم في الأجهزة بأفكارك. يحدث هذا عندما يستخدم جهاز إشارات من المخ للتحكم في شيء ما مثل
   - مؤشر على الكمبيوتر.
   - حركة الأصابع كجزء من طرف اصطناعي.
2. يمكن استخدام الحواسب الفائقة والذكاء الاصطناعي:
   - لمراجعة البيانات الصحية الفردية.
   - لتطوير علاجات مخصصة من الكم الهائل من المواد المتاحة في قواعد البيانات العامة والمراجع الطبية والدوريات العلمية.

Tick (✓) or (✗) in front of the tasks robots could do to help doctors.

- [ ] Making accurate surgeries.
- [ ] Controlling finger movement as part of a prosthetic limb.
- [ ] Reviewing individual health data and comparing it with large public databases.

Projects

Industry

- Artificial intelligence can be used to do tasks that are too dangerous for humans to perform, such as mining, nuclear power plants and construction.
- Robots are used to reduce the risk of accidents and injuries to humans.

Mining



Nuclear Power Plant



Construction



- يمكن استخدام الذكاء الاصطناعي في أداء مهام يصعب على البشر القيام بها مثل التنقيب عن المعادن وتشغيل محطات الطاقة النووية والبناء.
- تستخدم الروبوتات لتقليل مخاطر الحوادث والإصابات للبشر.

Tick (✓) in front of the jobs robots could do to help keep humans safe.

- ☐ Fishing
- ☐ Firefighting
- ☐ Oil mining
- ☐ Delivering goods

Think of some jobs that robots could do to help keep humans safe.

1. ....
2. ....

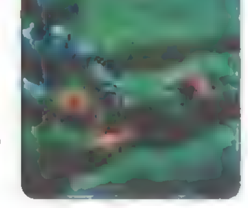
Artificial intelligence, as you have seen, influences many aspects of society and affects our economy. Think about jobs in your area that may be affected by the continued development of artificial intelligence. Jobs may be replaced by artificial intelligence.

1. ....
2. ....

Agriculture

- Artificial intelligence affects our economy.
- Farmers are under increased pressure to produce more crops to feed more people.

1 Robotics in Agriculture:



- Robots are being developed to do complex tasks that have not been possible in the past.
- Farming robots can:
  1. Manipulate their environment by picking vegetables or fruits.
  2. Applying pesticides in a localized manner and planting seeds.
- Sensors on robotic arms can tell which berries are ripe (fully-grown and ready to eat) and which are not based on the shape and size of the berry.

2 Precision Agriculture:



- Precision physical systems use artificial intelligence to keep plants healthy by dispensing water, seeds, fertilizer, and other resources that keep plants healthy through a web application, like a popular farming game.

في مجال الزراعة:

• يؤثر الذكاء الاصطناعي في اقتصادنا. • المزارعون يتعرضون للضغط المتزايد لإنتاج المزيد من المحاصيل لإطعام المزيد من الناس.

1 الروبوتات في الزراعة:

تطورت الروبوتات للقيام بمهام معقدة لم تكن ممكنة في الماضي، حيث يمكن للروبوتات الزراعية:

– التعامل مع البيئة المحيطة بهم من خلال جمع الخضراوات أو الفواكه.

– استخدام المبيدات الحشرية في مناطق محددة أو زراعة البذور.

يمكن أن تخبرنا المستشعرات على ذراع الروبوت أي حبة توت ناضجة وأيها غير ناضجة بناءً على شكلها وحجمها.

2 يمكن للأنظمة الدقيقة الأخرى أن توزع المياه، وتنثر البذور، وترش الأسمدة والموارد الأخرى التي تحافظ على صحة النبات من خلال تطبيق على شبكة الإنترنت، مثل لعبة من ألعاب الزراعة الشهيرة.

Tick (✓) or (✗) in front of the tasks robots could do to help farmers.

- ☐ Dispensing water and fertilizers to improve crop yields and keep plants healthy.
- ☐ Robots can do photosynthesis process instead of plants.

Glossary

Theme 1 – Unit 1 – Concept 1

Lesson (1)

Systems الأنظمة	Cell الخلية	Basic units الوحدات الأساسية
Microscope المجهر	Growing النمو	Repairing damaged cells تعويض الخلايا التالفة
Reproducing التكاثر	Responding الاستجابة	Trillions تريليونات
Common مشترك	Life processes العمليات الحيوية	Unfertilized bird egg بيضة الطائر غير المخصبة
Unicellular organisms كائنات وحيدة الخلية	Multicellular organisms كائنات عديدة الخلايا	Complex structure تركيب معقد
Building blocks وحدات البناء	Taking in أخذ	Releasing للتخلص من
Waste products الفضلات	Cell membrane الغشاء الخلوي	Maintain الحفاظ
Balance توازن		

Lesson (2)

Unaided eye العين المجردة	Sample عينة	Tiny صغير جدًا
Improved microscopes أجهزة الميكروسكوب المطورة	Observation مراقبة	Numerous العديد
In more detail بشكل مفصل (دقيق)	Onion بصل	Distilled water ماء مقطر
Eyedropper قطارة	Glass slide شريحة زجاجية	Coverslip غطاء شريحة
Forceps ملقط	Components مكونات	Magnifies يكبر
Magnifying power قوة التكبير	Slide شريحة	Illuminator مصدر إضاءة
Base قاعدة	Secure محكم	

Lesson (3)

Variety اختلاف	Cell wall جدار الخلية	Photosynthesis البناء الضوئي
Plasma membrane غشاء بلازمي	Mineral nutrients الأملاح المعدنية	Nucleus نواة
Tissue نسيج	Cytoplasm السيتوبلازم	Organ عضو
Cellulose السليلوز	Organ system نظام العضو	Regulates ينظم
Entire organism كائن حي كامل	Organelles العضيات	Nerve cell خلية عصبية
Vary يختلف	Parent cell الخلية الأصل	Mitochondria الميتوكوندريا
Circulatory system الجهاز الدوري	Selectively permeable نفاذية اختيارية	DNA الحمض النووي
Individual genes الجينات الفردية	proteins بروتينات	

Lesson (4)

Granules حبيبات	Sacs حويصلات	Pigment chlorophyll صبغة الكلوروفيل
Chloroplast البلاستيدات الخضراء	Rigid structure هيكل صلب/متماسك	Exoskeleton هيكل خارجي
Endoplasmic reticulum الشبكة الإندوبلازمية	Golgi apparatus جهاز جولجي	Vacuole فجوة عصارية
Cell membrane غشاء الخلية	Assembling تجميع	Storage تخزين

Lesson (5)

Typical نموذجي	Internal structure هيكل داخلي	Biologists علماء الأحياء
Interact يتفاعل	Investigate يبحث / يفحص	Analyze data تحليل بيانات
Medication دواء	Agriculture زراعة	Stains صبغات
Highlight يبرز		

Theme 1 – Unit 1 – Concept 2

Lesson (1)

Nervous متوتر	Heart raced تسارع نبضات القلب	Chills قشعريرة
Perspire يتعرق	Individual فرد	Skeletal system الجهاز الهيكلي
Sympathetic nervous system الجهاز العصبي السمبثاوي	Acute stress التوتر الشديد	Adrenal glands الغدد الكظرية
Heart rate معدل ضربات القلب	Blood pressure ضغط الدم	Breathing rate معدل سرعة التنفس
Physical responses استجابات حسية	Fight مقاومة / قتال	Flee الفَرّ
Contract تنقبض	Nerve cells الخلايا العصبية	Nutrients العناصر الغذائية

Lesson (2)

Multicellular organisms الكائنات عديدة الخلية	Specific functions وظائف محددة	Variety تنوع
Muscle cells الخلايا العضلية	Effective فعالة	Elbow الكوع
Shoulder الكتف	Organ عضو	Biceps العضلة ثنائية الرأس
Bones عظام	Limbs أطراف	Gut القناة الهضمية
Musculoskeletal system الجهاز العضلي الهيكلي	Triceps العضلة ثلاثية الرءوس	Bend يثني
Skeletal muscles العضلات الهيكلية	Relaxation الانبساط	Contraction الانقباض

Lesson (3)

Involuntary لاإرادية	Voluntary إرادية	Automatic تلقائي
Cardiac muscle العضلات القلبية	Heartbeat نبض القلب	Pumps يضخ

Glossary

English	Arabic	English	Arabic	English	Arabic
Shallow	ضحل	Blink	يرمش	Eyelid	جفن العين
Forearm	الساعِد	Arm	ذراع	Diaphragm	الحجاب الحاجز
Side	جانب	Lungs	الرئتان	Scary movie	فيلم رعب
Face danger	مواجهة الخطر	Stress	ضغط	Threat	تهديد
Initiate	يبدأ	Endocrine system	جهاز الغدد الصماء	Circulatory system	الجهاز الدوري
Hormones	الهرمونات	Blood vessels	الأوعية الدموية	Veins	الأوردة
Arteries	الشرايين	Capillaries	الشعيرات	Respiratory system	الجهاز التنفسي

Lesson (4)

English	Arabic	English	Arabic	English	Arabic
Fuel	وقود	Carbohydrates	الكربوهيدرات	Proteins	البروتينات
Fats	الدهون	Busy	مشغول	Digestion	عملية الهضم
Jaw muscles	عضلات الفك	Saliva	اللعاب	Chew	يمضغ
Soften	تليين	Enzyme	إنزيم	Esophagus	المريء
Stomach	المعدة	Churning	الحركة التموجية	Small intestine	الأمعاء الدقيقة
Pancreas	البنكرياس	Gallbladder	الحويصلة الصفراوية	Assist in	يساعد على
Large intestine	الأمعاء الغليظة	Solid waste	فضلات صلبة	Situation	موقف
Soupy mixture	مزيج سائل	Feces (stool)	براز	Rectum	المستقيم
Anus	فتحة الشرج	Sick	مريض	Excretion	عملية الإخراج
Skin	الجلد	Urinary system	الجهاز البولي	Exhale	زفير
Sweat	عرق	Kidney	كلية	Nephrons	النفرونات
Filter	ينقي	Harmful substances	مواد ضارة	Urea	اليوريا
Urine	البول	Bladder	المثانة	Slender tube	أنبوب رفيع
Urethra	القناة البولية	Urination	عملية التبول	Food-processing machine	آلة تُجري عملية معالجة للطعام
Bite					

Lesson (5)

English	Arabic	English	Arabic	English	Arabic
Beans	فاصولياء	Rice	أرز	Red blood cells	كرات الدم الحمراء
Membrane	غشاء				

Lesson (6)

English	Arabic	English	Arabic	English	Arabic
Bloodstream	مجرى الدم	Insulin	هرمون الأنسولين	Diabetes	مرض السكر
Disorder	اضطراب	Monitor	مراقبة	Regular shots	جرعات منتظمة
Insulin pump	مضخة الإنسولين	Injections	حقن	Artificial pancreas	بنكرياس صناعي
External	خارجي	Internal	داخلي	Researchers	الباحثون

Theme 1 – Unit 1 – Concept 3

Lesson (1)

Wires	أسلاك	Electrical poles	الأعمدة الكهربية	Electric circuit	الدائرة الكهربية
Charged particles	جسيمات مشحونة	Closed path	مسار مغلق	Switch	مفتاح
Battery	بطارية	Light bulb	مصباح	Purpose	غرض
Ways of connection	طريقة التوصيل	Series circuit	التوصيل على التولي	Parallel circuit	التوصيل على التوازي
Single	وحيد	Multiple	متعدد	Turn off	يغلق
Magnetism	المغناطيسية	Noncontact forces	قوى عدم تلامس	Invisible forces	قوى غير مرئية
Mass	الكتلة	Astronauts	رواد الفضاء	Attract	يجذب
Distance	مسافة	North Pole	القطب الشمالي	Repel	يتنافر
Motors	المحركات	South Pole	القطب الجنوبي	Iron filings	برادة الحديد

Lesson (2)

Copper wire	سلك من النحاس	Paperclips	مشابك ورقية	Cardboard	ورق مقوى
Steel pins	دبابيس صلب	Nail	مسمار	Magnet	مغناطيس
Aluminum foils	رقائق الألومنيوم	Eraser	ممحاة	Turbine	توربين
Generators	المولدات الكهربية	Renewable	متجدد	Nonrenewable	غير متجدد
Resources	مصادر	Conductors	موصلات	Rate	معدل
Spin	يدور	Fuel	وقود	Oil	الزيت
Coal	فحم	Steam	البخار		

Lesson (3)

Electrons	إلكترونات	Manual switch	مفتاح يدوي	Automatic switch	مفتاح آلي
Thermostat	ثرموستات	Rubber	مطاط	Plastic	بلاستيك
Insulator	المواد العازلة	Electric shock	صدمة كهربائية		

Lesson (4)

Wire = cord	سلك	Tape	شريط لاصق	Coins	عملات معدنية
Cloth	قماش	Conductivity	التوصيل	Steel	صلب
Magnetic field	المجال المغناطيسي	Metal core	قالب معدني		

Lesson (5)

Resistors	مقاومة كهربية	Electrical current	التيار الكهربي	Limit	تحد من
Interact	يتفاعل	Toaster	محمصة الخبز	Microwave	الميكروويف
Electric stove	الفرن الكهربي	Loops	لفات سلك	Branches	فروع

Load	حمل كهربي	Blender	الخلاط	Power plant	محطة توليد الكهرباء
Power lines	خطوط الطاقة	Businesses	الشركات		

Lesson (6)

Coil	لف	Hollow cylinder	أسطوانة مجوفة	Galvanometer	الجلفانومتر
Needle	مؤشر	Muscle	عضلة	Organ	عضو
Beat	ينبض	Pacemaker	منظم ضربات القلب	Contract	ينكمش
Chest	الصدر	Regular intervals	فترات منتظمة	Irregular heartbeat	ضربات قلب غير منتظمة
Physicians	الأطباء	Effective	فعال	Motherboard	لوحة التحكم

Theme 2 – Unit 2 – Concept 1

Lesson (1)

Pool	ينبوع الماء	Magma	الصخور المنصهرة	Steam	بخار
Particles	جسيمات	Tiny	صغيرة جدًا	Sum	مجموع
Measure	مقياس	Blowing	النفخ	Atoms	ذرات
Molecules	جزيئات	Hollow tube	أنبوبة مجوفة	Maintain	يحافظ على
Fixed	ثابت	Pot	إناء		

Lesson (2)

Kinetic energy	الطاقة الحركية	Thermal energy	الطاقة الحرارية	Property	خاصية
Conduction	التوصيل	Convection	الحمل	Radiation	الإشعاع
Temperature	درجة الحرارة	Thermometer	الترمومتر		

Lesson (3)

Melting	عملية الانصهار	Evaporation	عملية التبخير	Freezing	عملية التجميد
Condensation	عملية التكثيف	Vibrate	تهتز	Loss	فقدان
Attractive forces	قوى التجاذب	Physical properties	خواص فيزيائية	Boiling point	درجة الغليان
Melting point	درجة الانصهار	Extreme conditions	ظروف قاسية	Ocean currents	تيارات المحيط
Beaker	دورق	Food coloring	ألوان الطعام	Eyedropper	قطارة
Dye	صبغة				

Lesson (4)

Force	القوة	Weak	ضعيف	Spread out	تنتشر
Rubber ball	كرة مطاطية	Expansion	تمدد	Contraction	انكماش
Volume	حجم	Alcohol	كحول	Jar	برطمان
Bridges	الجسور- الكباري	Expansion joints	وصلات التمدد	Buckle	ينبعج

Lesson (5)

Clay صلصال	Straw ماصة	Bowl إناء
Pour يصب	Height ارتفاع	Rises up يرتفع لأعلى

Lesson (6)

Buckling الانحناء	Cracking التشقق	Concrete الخرسانة
Steel الصلب	Railroad tracks خطوط السكك الحديدية	Sidewalks الأرصفة

Theme 2 – Unit 2 – Concept 2

Lesson (1)

Molecules الجزيئات	Heat up يسخن	Slow down يبطء
Lizard's skin جلد السحلية	Heat transfer انتقال الحرارة	Contact اتصال
Ironing كي الملابس	Wrinkles التجاعيد	Handle مقبض
Insulators المواد العازلة	Resist يقاوم	Conductors الموصلات
Burn يحرق	Metals المعادن	Iron حديد
Smooth out يفرد		

Lesson (2)

Vibrating تهتز	Atoms الذرات	Measure in unit القياس بالوحدة
Calories سعرات حرارية	Cooking food طهي الطعام	Warm دافئ
Objects أشياء	Hitting ضرب	Thermal equilibrium توازن حراري
Average temperature متوسط درجة الحرارة	Final temperature درجة الحرارة النهائية	Add يضيف
Fix يثبت		

Lesson (3)

Conduction التوصيل	Convection الحمل الحراري	Radiation إشعاع
Sore muscle التهاب العضلات	Heating pad وسادة التدفئة	Tendency of being hot الميل إلى السخونة
Heat wave موجة الحر	Emitted المنبعثة	Electromagnetic waves موجات كهرومغناطيسية
Cooler أكثر برودة	Shadier sidewalk رصيف أكثر ظلًا	Copper نحاس
Iron حديد	Brass نحاس	Meteorologists خبراء الأرصاد الجوية
Predict يتنبأ	Weather طقس	Cookware تجهيزات المطابخ

Glossary

Lesson (4)

Handle	مقبض	Comfortable	مريح	Pans	أواني الطهي
Popcorn kernels	حبات الذرة	Thermos	ترمس	Stove	الفرن
Chocolate bar	قالب شيكولاتة	Popped corn	الفشار		

Lesson (5)

Track	طريق	Curves	منحنيات	Marble	كرة البلي
Kinetic energy	طاقة الحركة	Hills	تلال	Loops	حلقات
Friction	احتكاك	Potential energy	طاقة الوضع		

Lesson (6)

Purposes	أغراض	Mixture	خليط	Combination	اتحاد
Petroleum compounds	المركبات البترولية	Steel	الصلب	Limestone	الحجر الجيري
Smart clothes	الملابس الذكية	Molecular levels	التركيب الجزيئي	Improve	يحسن
Chemical change	تغير كيميائي	Shrink-wrap	أنابيب الانكماش الحراري	Resists burning	يقاوم الاحتراق
Concrete	الخرسانة	Soda ash	رماد الصودا	Flexible fabric	نسيج مرن
Bricks	طوب البناء				